Reinstatement and revision of *Sphaeromorphaea* DC. and *Ethuliopsis* F.Muell. (Asteraceae: *Plucheinae*)

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Summary

Bean, A.R. (2013). Reinstatement and revision of *Sphaeromorphaea* DC. and *Ethuliopsis* F.Muell. (Asteraceae: *Plucheinae*). ***Austrobaileya* 9(1): 30–59.** *Sphaeromorphaea* DC. and *Ethuliopsis* F.Muell., historically included in *Epaltes* Cass., are reinstated and taxonomically revised. *Sphaeromorphaea* occurs in Australia, Indian Subcontinent, Indochina, China, eastern Asia, Malesia, Papuasia, northwestern Pacific and southwestern Pacific, and comprises six species. Three new species; *S. ephemera* A.R.Bean, *S. major* A.R.Bean and *S. subintegra* A.R.Bean are described, and two new combinations; *S. harrisii* (F.Muell.) A.R.Bean and *S. littoralis* (Retz.) A.R.Bean are made. *Ethuliopsis* occurs only in Australia and comprises the single species *E. cunninghamii* (Hook.) F.Muell. A neotype is chosen for *Epaltes australis* Less., and lectotypes are chosen for *Artemisia littoralis* Retz., *Ethulia cunninghamii* Hook. and *Epaltes harrisii* F.Muell. Descriptions, illustrations and distribution maps are provided for all taxa. Diagnostic morphological characters and ecological aspects are discussed, and identification keys are provided to the species and to the Australian genera of Subtribe *Plucheinae*.

Key Words: Asteraceae, *Plucheinae*, *Epaltes*, *Ethuliopsis*, *Sphaeromorphaea*, *Sphaeromorphaea ephemera*, *Sphaeromorphaea harrisii*, *Sphaeromorphaea littoralis*, *Sphaeromorphaea major*, *Sphaeromorphaea subintegra*, Australia flora, India flora, China flora, taxonomy, new species, identification key, distribution maps

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Introduction

Sphaeromorphaea DC. and *Ethuliopsis* F.Muell. are often regarded as synonyms of *Epaltes* Cass. (Cooke 1986; Bremer 1994; Anderberg & Eldenas 2007; GRIN 2012) and their histories are intertwined.

Cassini (1818) named the genus *Epaltes* with a single species *Epaltes divaricata* (L.) Cass., native to the Indian subcontinent, China and Indochina. C.F. Lessing added *Epaltes australis* Less., *E. mexicana* Less. and *E. hirsuta* Less. in 1830 and 1832. In the ensuing century, nearly 20 *Epaltes* species were described from all tropical parts of the world.

Sphaeromorphaea was named by De Candolle (1838) with three species at that time, two originating from southern Asia and one from Australia. No other species were subsequently described under that generic name; however, the combination *S. australis* (Less.) Kitam., based on *Epaltes australis* Less., was made in 1936.

In Australia, Mueller (1861) proposed a new genus, *Ethuliopsis*, to accommodate *Ethulia cunninghamii* Hook. Bentham (1867) relegated *Ethuliopsis* to synonymy with *Epaltes*, while maintaining *Epaltes australis*; the two species he placed in *Epaltes* (*E. australis*, *E. cunninghamii* (Hook.) Benth.) were to remain there for well over a century.

Bentham (1873) dealt incompletely with *Sphaeromorphaea*, saying correctly only that it is, in part, synonymous with *Centipeda* Lour. One of the three named species, *S. centipeda* DC., is a nomenclatural synonym of *Centipeda minima* (L.) A.Braun & Asch. Hooker (1882) accepted *Sphaeromorphaea* with a single species (for India), *S. russeliana* DC., and placed the genus next to *Centipeda* in his systematic arrangement.

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Mueller described three further species under *Epaltes* (*E. harrisii* F.Muell., *E. tatei* F.Muell. and *E. pleiochaeta* F.Muell.) from Australia; Moore & Betche (1893) listed *E. pleiochaeta* as an accepted species, and Bailey (1900) listed *E. harrisii* as an accepted species, but neither name ever came into general usage. *Epaltes tatei* is an accepted species that was transferred to a new genus, *Haegiela* P.S.Short & Paul G.Wilson (Short & Wilson 1990), belonging to the Tribe *Gnaphalieae*.

Contemporary Asian flora treatments have used either *Epaltes australis* or *Sphaeromorphaea australis* for the taxa found there. For Taiwan, Li (1978) accepted *S. australis*, but Peng (2004) reversed this, with *Epaltes australis* then the accepted name; Naithani (1995) accepted *S. australis*, placing the genus near *Centipeda* in the Tribe *Anthemideae*; Hu & Wong (2009) used *E. australis* as the accepted name, with *S. australis* given as a synonym.

In recent decades *Epaltes* has been regarded as a heterogenous genus incorporating any Plucheoid taxa whose achenes lack pappus bristles (Leins 1971; Merxmueller *et al.* 1978; Cooke 1986; Anderberg 1991). The present author agrees that *Epaltes* is paraphyletic, and that the Australian species currently referred to that genus belong in *Sphaeromorphaea* DC. or *Ethuliopsis* F.Muell.

Dunlop (2000) was the first author to accept the genus name *Sphaeromorphaea* (and the species *S. australis*) in an Australian flora treatment and some major Australian herbaria subsequently adopted *Sphaeromorphaea* for their state in plant checklists or censuses (Walsh & Stajsic 2007; Short *et al.* 2011). Short & Wilson (1990) foreshadowed the acceptance of the genus name *Ethuliopsis*, but the Australian Plant Census (APC 2012) continued to list it as a synonym of *Epaltes*.

Sphaeromorphaea and *Ethuliopsis* are revised in this paper. Six species of *Sphaeromorphaea* are enumerated, including three new species and two new combinations; all of these species have previously been referred to a broadly circumscribed *Epaltes australis*. They occur in Australia, Indian subcontinent, Indochina, China, eastern Asia, Malesia, Papuasia, northwestern Pacific and southwestern Pacific. *Ethuliopsis* is monotypic, and is endemic to Australia.

Materials and methods

This revision is based on a morphological study of herbarium specimens from A, AD, AMES, BM, BRI, C, CANB, GH, K, LD, MEL, PE, PERTH and TAI. Images of specimens, mainly types, from BM, C, CAL, G-DC, K, M and P have been examined. In addition, the author has collected and studied plants in the field in Queensland, New South Wales and the Northern Territory.

All measurements were made from dried material, using a stereo microscope equipped with a graticule. Commonly used abbreviations in the specimen citations are HS for Homestead, NP (National Park), SF (State Forest).

The distribution maps were compiled using DIVA-GIS Version 7.5.0, using label data of specimens from the herbaria listed above.

Geographical regions are listed according to the scheme of Brummitt (2001); for the generic distributions, the areas cited are Regional Names; for the specimen citations, the areas cited are Level 3 Names. Specimen citations within Queensland are further subdivided into Pastoral districts.

Relationships

Anderberg (1991) provided a cladistic analysis of the subtribe *Plucheinae* based on morphological characters. He reinstated the African genus *Litogyne* Harv., and transferred *Epaltes gariepina* (DC.) Steetz to it, based mainly on the very different shape of the receptacle. *Litogyne* has since gained some acceptance as a distinct genus (Retief & Herman 1997; Beentje 2002).

Anderberg (1991) studied material of the following *Epaltes* species: *E. australis*, *E. brasiliensis* (Link) DC., *E. cunninghamii* and *E. mattfeldii*. Interpretation of his data is fraught because *E. australis* is here

regarded as belonging to *Sphaeromorphaea*, *E. cunninghamii* is regarded as belonging to *Ethuliopsis*, and the generic status of *E. brasiliensis* and *E. mattfeldii* is uncertain. The type species of *Epaltes* (*E. divaricata*) was not included in the analysis.

Anderberg (1991) placed *Thespidium* F.Muell. ex Benth. and *Coleocoma* F.Muell. in the 'Coleocoma group', while *Epaltes* was placed in the 'Pluchea group'. The present author is of the opinion that while *Epaltes sens. str.* and *Ethuliopsis* probably do belong in the 'Pluchea group', *Sphaeromorphaea* belongs to the 'Coleocoma group' and is most closely related to the monotypic genus *Thespidium*. The persistent ebarbellate bristles formed on the achenes of some *Sphaeromorphaea* spp. are very similar to those of *Thespidium basiflorum* (F.Muell.) Benth., and the cylindrical longitudinally-ribbed achenes are a feature of both genera. Leins (1971) had previously proposed a close relationship between *Epaltes australis* and *Thespidium* based on a study of the pollen grains and style morphology.

The molecular study of Anderberg *et al.* (2005) placed *Coleocoma*, *Streptoglossa* Steetz and *Epaltes cunninghamii* (i.e. *Ethuliopsis*) as part of a largely unresolved clade dominated by species of *Pluchea* Cass.

The presence of a coronal pappus is a uniting character for all species of *Sphaeromorphaea* and *Ethuliopsis*. Coronal pappus is not common in Asteraceae, being confined to some genera in Tribe *Anthemideae* and Tribe *Inuleae* (Heywood & Humphries 1977; Mukherjee & Sarkar 2001).

The species of *Sphaeromorphaea* and *Ethuliopsis* differ from *Epaltes sens. str. (E. divaricata)* in a number of significant ways (**Tables 1 & 2**):

Table 1. Morphological character differences between *Sphaeromorphaea* and *Epaltes divaricata*

Characters	*Sphaeromorphaea*	*Epaltes divaricata*
stems	not winged	winged
capitula	borne usually in pairs	borne singly
involucral bracts	mostly obtuse, cartilaginous, incurved	all acute, herbaceous, straight or excurved
marginal florets	conical or lageniform, or filiform with an expanded base	filiform, not significantly expanded at the base
style of disc florets	rather slender, not divided	style arms short and broad, distinctly divided
pappus	a stiff persistent corona, bristles sometimes present	no corona, no bristles
achenes of disc florets	full sized, often indistinguishable from marginal-floret achenes	not formed; ovary vestigial
achene shape	cylindrical	ellipsoidal to obovoid
carpophore	prominent white ring	small, obscure

Table 2. Morphological character differences between *Ethuliopsis* and *Epaltes divaricata*

Characters	*Ethuliopsis*	*Epaltes divaricata*
stems	not winged	winged
sexuality	subdioecious	bisexual
receptacle	hemispherical (in heterogamous capitula)	flat
style of disc florets	rather slender, not divided	style arms short and broad, distinctly divided
pappus	a persistent cylindrical corona, bristles present on disc florets	no corona, no bristles
achene shape and ribbing	lunate; 1-ribbed	ellipsoidal to obovoid; several-ribbed
carpophore	prominent white ring	small, obscure

In *Ethuliopsis*, some plants bear homogamous capitula (with disc florets only), while other plants bear heterogamous capitula (nearly all marginal florets, but with a few disc florets). In *Epaltes divaricata*, all capitula on all plants are heterogamous.

Ecology and distribution

Ethuliopsis cunninghamii is an erect annual herb reaching one metre in height. It is found on alluvial flats with heavy clay soils, in swamps, or beside river channels and lakes. It is endemic to arid and semi-arid eastern Australia.

All *Sphaeromorphaea* species are herbs or small shrubs 15–60 cm high or wide. Some species are seemingly annual (e.g. *S. ephemera*), while other species can develop a substantial taproot and probably live for two or three years, with older stems dying, replaced by new stems shooting from near the base of the plant. They prefer sunny areas with bare soil in grasslands, sedgelands, woodlands or forests. They appear to have no edaphic preference, occurring on soils as diverse as pure beach sand and heavy cracking clays.

All *Sphaeromorphaea* species inhabit places where the soil is intermittently or permanently moist or wet. Poor drainage is readily tolerated, but they will not persist where there is standing water. They can most often be found on alluvial flats, in swamps, or beside rivers and lakes; however, some species can also occur in hilly terrain, where they occupy the wetter microhabitats, such as depressions, drains and gullies.

Most species display a considerable tolerance for high levels of salt in the soil or in the air. One species (*Sphaeromorphaea major* A.R.Bean) is confined to marine couch grasslands, and most other species sometimes inhabit salt affected areas. *S. australis* can grow on coastal headlands, exposed to salty winds. Label data suggest that *S. subintegra* A.R.Bean sometimes grows on serpentinite, a substrate well known to be toxic to many plant species.

Waterbirds are well known as dispersal agents for the seeds of wetland plants (e.g. Figuerola & Green 2002; Soons *et al.* 2008), and although there is no literature documenting the dispersal of *Sphaeromorphaea* or *Ethuliopsis*, it seems reasonable to assume that waterbirds play a major role. This would help explain the distribution of *S. littoralis*, which is widespread from southern Australia to southern Asia. Its apparent absence from Indonesia may be partly due to the

predominance of rainforest communities that are not suitable habitat for the light-loving *Sphaeromorphaea*.

It is interesting to note that *Sphaeromorphaea* and the ecologically comparable genus *Centipeda* (taxonomy revised by Walsh [2001]) have similar distribution patterns, to the extent of possessing a single widespread species shared by southern Asia and Australia, and a centre of diversity in Australia.

Some diagnostic morphological characters

1. Resin globules

Ethuliopsis and most species of *Sphaeromorphaea* have resin globules on the lower and often on the upper leaf surfaces, and on the corollas and achenes. They are shining, transparent and globose, but may be difficult to see in very old herbarium specimens, as with age they degrade and deflate. Their presence, distribution and sometimes their numbers are diagnostic. *S. major* does not have resin globules.

2. Leaf and stem indumentum

Sphaeromorphaea major has glabrous leaves and stems. All other species bear crisped, multicellular, eglandular hairs, at least on young developing leaves and stems. For *S. ephemera* and *Ethuliopsis cunninghamii*, leaves are glabrous at maturity; *S. australis* may be glabrous or sparsely hairy. For *S. littoralis*, *S. harrisii* and *S. subintegra*, at least some hairs persist on mature leaves. Leaf indumentum is particularly variable in *S. littoralis* and *S. harrisii*; sometimes sparsely hairy and sometimes densely hairy on fully expanded leaves.

3. Leaf shape and margins

Sphaeromorphaea species have leaves that at first glance appear petiolate, but they are in fact sessile, as the lamina does extend to the stem in all taxa. In most species, the leaf shape is more or less obovate, but *S. major* is distinguishable by being especially narrow-leaved. No species has entire margins; in *S. subintegra* the margins are denticulate with teeth less than 0.5 mm long, and hence may appear entire without close inspection. In *S. australis*, some large teeth or lobes (>1 mm long) are usually present, often on the basal part of the lamina (the pseudo-petiole). *Sphaeromorphaea littoralis* and *S. harrisii* similarly are often conspicuously toothed on some leaves, with the teeth extending to the basal half of the lamina.

Ethuliopsis cunninghamii leaves are not pseudo-petiolate, and the lamina is broad almost to the base. The leaf margins are denticulate to dentate.

4. Marginal floret shape

The shape of the marginal florets is an important diagnostic character for *Sphaeromorphaea*. In *S. littoralis*, *S. subintegra* and *S. ephemera*, the corolla is consistently conical, tapering more or less evenly from the base to the very narrow apex (e.g. **Fig. 3E**); in *S. australis* and *S. harrisii*, the corolla is consistently lageniform i.e. swollen in appearance, broadest above the base, then tapering rapidly towards the apex (**Figs. 1G, 2C**); in *S. major* and *Ethuliopsis cunninghamii*, the corolla of the marginal florets is filiform (**Figs. 1C, 4H**).

5. Achene features

All *Sphaeromorphaea* achenes are cylindrical, providing an instant distinction from *Ethuliopsis* whose achenes are lunate. *Ethuliopsis* achenes have a single adaxial longitudinal rib, although several anastomosing veins on the surface are often also visible. The number of longitudinal ribs for *Sphaeromorphaea* species varies from 5–14, and is moderately diagnostic for each species. In *S. littoralis* and *S. harrisii*, there is a whorl of antrorse to appressed twin hairs at the base of the achene, with a few twin hairs sometimes occurring also on the achene body. In other species, the twin hairs are nearly always absent, although *S. australis* and *S. subintegra* may occasionally have 1–4 twin hairs at the achene base.

6. Pappus corona

All species of *Sphaeromorphaea* and *Ethuliopsis* have a stiff persistent coronal pappus. In *Ethuliopsis cunninghamii* and in *Sphaeromorphaea major*, the corona is

erect and shortly cylindrical with an entire or fimbriate margin, while in the other species of *Sphaeromorphaea*, it is annular or disc-like, transverse or nearly so, with an entire, pentagonal or erose margin (**Fig. 3G**). The width (and therefore the visibility) of this corona varies with the species; in *S. littoralis*, *S. harrisii* and *S. subintegra* it is relatively broad and easy to see, while in *S. australis* and *S. ephemera*, it is very narrow and difficult to detect.

7. Pappus bristles

In some species of *Sphaeromorphaea* pappus bristles emerge from the margin of the corona. They are consistently ascending, terete, persistent, and shorter than the corolla. With the exception of *S. major*, they lack barbellae. Sometimes only a single bristle is produced, but there may be as many as five. The length and number of bristles produced may differ according to the type of floret; *S. major* can produce up to five bristles on the disc achenes, but not more than three on the marginal achenes. Pappus bristles occur frequently in *S. harrisii* and *S. major*, but only rarely in *S. littoralis* and *S. subintegra*; they have not been observed for *S. australis* and *S. ephemera*. *Ethuliopsis* consistently produces slightly flattened barbellate bristles on the disc florets, but never any bristles on the achenes.

In summary, *Sphaeromorphaea* is characterised by the hemispherical to oblate capitula borne singly or in pairs opposite a leaf; the cartilaginous incurved glabrous involucral bracts; the presence of a coronal pappus (sometimes produced into slender persistent bristles); the cylindrical achenes, formed from all florets (though achenes produced from disc florets may not be fertile), glabrous or with straight twin hairs mainly at the base. *Ethuliopsis* is characterised by the subdioecious habit; the vestigial ovary of the disc florets; white corollas; barbellate pappus bristles on the disc florets; and the glabrous one-ribbed lunate achenes with a cylindrical coronal pappus, obliquely placed on the achene.

Taxonomy

Sphaeromorphaea DC., *Prodr.* 6: 140 (1838). **Type:** *S. russeliana*, *fide* J.R. Drummond in Merrill & Rolfe (1908: 126) [= *S. littoralis*].

Annual or perennial herbs with a well developed rootstock. Latex absent. Indumentum of crisped, multicellular, eglandular hairs. Sessile to very shortly stalked resin globules frequently present on stems, leaves, involucral bracts, corolla and achenes, initially shiny and transparent, becoming opaque and deflated with age. Stems terete, not winged. Leaves alternate, sessile, spreading; margins denticulate, dentate or lyrate; base attenuate, not decurrent. Capitula axillary or leaf-opposed, solitary or in pairs on often short peduncles, hemispherical to depressed-globose, disciform, heterogamous. Involucral bracts subequal in length, cartilaginous, incurved, in 3–4 rows, innermost row conspicuously narrower. Receptacle flat, glabrous, without paleae. Marginal florets fertile, female, without rays; corolla without multicellular hairs, resin globules present or absent, white or pink to purple at anthesis; lobes 3, tiny; style with bulbous base, branches divergent. Disc florets bisexual, usually producing achenes, but in some species infertile; corolla cylindrical to narrowly campanulate, without multicellular hairs, resin globules present or absent, pink to maroon; lobes 4 or 5; anthers tailed, apically obtuse; style bulbous at the base, divided or undivided at apex, sweeping hairs obtuse and extending well down the shaft. Achenes cylindrical, longitudinally ribbed; carpopodium ring-like, prominent, white. Pappus comprising a stiff, transverse or erect annular corona, sometimes produced into short slender persistent bristles. Twin hairs (when present) straight, antrorse to appressed, in a basal whorl, and occasionally on body of achene.

Six species, occurring in Australia, Indian subcontinent, Indochina, China, eastern Asia, Malesia, Papuasia, northwestern Pacific and southwestern Pacific.

Key to the species of *Sphaeromorphaea* using microscopic characters

1 Corolla of marginal florets lageniform **2**
1. Corolla of marginal florets conical or filiform **3**

2 Coronal pappus 0.02–0.05 mm wide, obscure; leaves glabrescent; marginal florets with several resin globules; pappus bristles always absent; achene hairs usually absent, or rarely 1–4 present at base . . . . . **2. S. australis**
2. Coronal pappus 0.05–0.08 mm wide, obvious; leaves persistently hairy; marginal florets with few or no resin globules; pappus bristles frequently present; hairs 5–20 at base of achene . . . . . **3. S. harrisii**

3 Fully expanded leaves sparsely to densely hairy; achenes with several resin globules . . . **4**
3. Fully expanded leaves glabrous; achenes without resin globules **5**

4 Leaves dentate or denticulate, teeth present on basal half of leaf; peduncles 2–14 mm long; achenes with 10–40 hairs, mainly at the base . . . . . **5. S. littoralis**
4. Leaves denticulate, teeth absent from basal half of leaf; peduncles 1.5–3.5 mm long; achene hairs usually absent, or rarely 1–4 present at base . . . **6. S. subintegra**

5 Pappus bristles absent; young stems and leaves sparsely hairy; fertile achenes 0.45–0.7 mm long . . . . . **4. S. ephemera**
5. Pappus bristles present on some florets; all stems and leaves glabrous; fertile achenes 1.0–1.3 mm long . . . . . **1. S. major**

Field key to the species of *Sphaeromorphaea*

1 Leaves narrow, 5.5–14 times longer than broad, without resin globules . . . . . **1. S. major**
1. Leaves broader, 2.3–5.3 times longer than broad, resin globules present **2**

2 Older leaves glabrous, bright green **3**
2. Older leaves sparsely to densely hairy, green to grey-green **4**

3 Annual; achenes without resin globules, marginal florets conical . . . . . **4. S. ephemera**
3. Perennial; achenes with resin globules, marginal florets lageniform . . . . . **2. S. australis**

4 Teeth on leaf margin very small on all leaves and absent from basal half . . **6. S. subintegra**
4. Teeth on leaf margin > 1 mm long on some leaves, teeth present on basal half **5**

5 Most stems erect; capitula almost sessile; pappus bristles frequently present; leaves deeply and irregularly lobed . . . . . **3. S. harrisii**
5. Most stems sprawling; capitula conspicuously pedunculate; pappus bristles rarely present; leaves shortly lobed, lobes fairly regular **6**

6 Leaves grey-green; achenes with numerous twin hairs at base and with conspicuous corona . . . . . **5. S. littoralis**
6. Leaves bright green; achenes lacking twin hairs at base (or just a few present) and with very narrow corona . . . . . **2. S. australis**

Diagnostic characters for *Sphaeromorphaea* species

Achenes with 5–40 twin hairs, mainly at base	*S. harrisii*, *S. littoralis*
Achenes with 1–4 twin hairs at base, or twin hairs absent	*S. australis*, *S. ephemera*, *S. subintegra*, *S. major*
Achene ribs 5–10	*S. australis*, *S. harrisii*, *S. littoralis*, *S. major*
Achene ribs 10–14	*S. australis*, *S. ephemera*, *S. littoralis*, *S. subintegra*
Corona transverse, prominent, > 0.05 mm wide	*S. harrisii*, *S. littoralis*, *S. subintegra*
Corona transverse, obscure, < 0.05 mm wide	*S. australis*, *S. ephemera*
Corona erect, entire or fringed	*S. major*
Marginal floret lageniform	*S. australis*, *S. harrisii*
Marginal floret conical	*S. ephemera*, *S. littoralis*, *S. subintegra*
Marginal floret filiform	*S. major*
Pappus bristles frequently present	*S. harrisii*, *S. major*
Pappus bristles rarely present	*S. littoralis*, *S. subintegra*
Pappus bristles absent	*S. australis*, *S. ephemera*

1. Sphaeromorphaea major A.R.Bean **sp. nov.** affinis *S. australi* sed acheniis longioribus costis longitudinalibus paucioribus, flosculorum discoideorum corolla 2–2.5 mm longa (in *S. australi* 1–1.3 mm) et foliis acheniis corollisque globulis resinae carentibus differens. **Typus:** Queensland. Port Curtis District: 100 metres from Huttonvale track, SE of Sabina Point, Shoalwater Bay Training Area, 8 April 2011, *A.R. Bean 30830 & D. Halford* (holo: BRI [1 sheet + spirit]; iso: BM, CANB, MEL, MO, *distribuendi*).

Prostrate or procumbent perennial shrub to 30 cm high and 60 cm across. Stems glabrous. Leaves linear to narrowly oblanceolate, 11–85 × 2–15 mm, 5.5–14 times longer than broad, glabrous, concolorous, resin globules absent; margins dentate to denticulate, with 3–6 pairs of teeth 0.1–0.7 mm long; apex acute or obtuse. Capitula solitary or in pairs, leaf opposed, hemispherical, 3–4.5 mm long, 4.5–8 mm wide; peduncles 2–28 mm long. Involucral bracts incurved, glabrous; median bracts ovate, 2.7–3.2 × 1.3–1.8 mm, apex acute or obtuse. Marginal florets 75–250, in several rows, female; corolla cylindrical, 1.5–2.4 mm long, apex very narrow, white, without resin globules. Disc florets 16–68, functionally male; corolla cylindrical to narrowly campanulate, 2–2.5 mm long, 0.25–0.35 mm wide near base, 0.4–0.5 mm wide near apex, pink, resin globules absent; lobes 4 or 5, triangular, each 0.4–0.5 mm long; style undivided. Achenes formed from all florets, but those from disc florets infertile. Marginal achenes fertile, cylindrical, 1–1.3 mm long, 0.25–0.3 mm wide, brown; ribs 5–10, white; twin hairs absent or 1–4, resin globules absent. Pappus corona almost erect, 0.02–0.05 mm high, margin entire or fimbriate; pappus bristles absent or with 1–3 bristles up to 1.9 mm long, and (in inland populations) with numerous short bristles. Disc achenes infertile, cylindrical, 0.8–1.7 mm long, 0.3–0.4 mm wide, white; ribs absent; pappus corona erect, white, margin entire or fimbriate; pappus bristles absent or with 1–5 barbellate bristles arising from the corona, up to 1.9 mm long. **Fig. 1A-D**.

***Additional specimens examined*: Queensland.** Port Curtis District: Broad Sound, Sep 1802, *Brown s.n.* (CANB, MEL); Bay of Inlets, Jun 1770, *Banks & Solander s.n.* (BM); 2 km NW of Seahound Hard ramp, Shoalwater Bay Training Area, N of Yeppoon, Feb 2012, *Bean 31610 & Mathieson* (AD, B, BRI, US, W, to be distributed); Ramsay Crossing, squatters

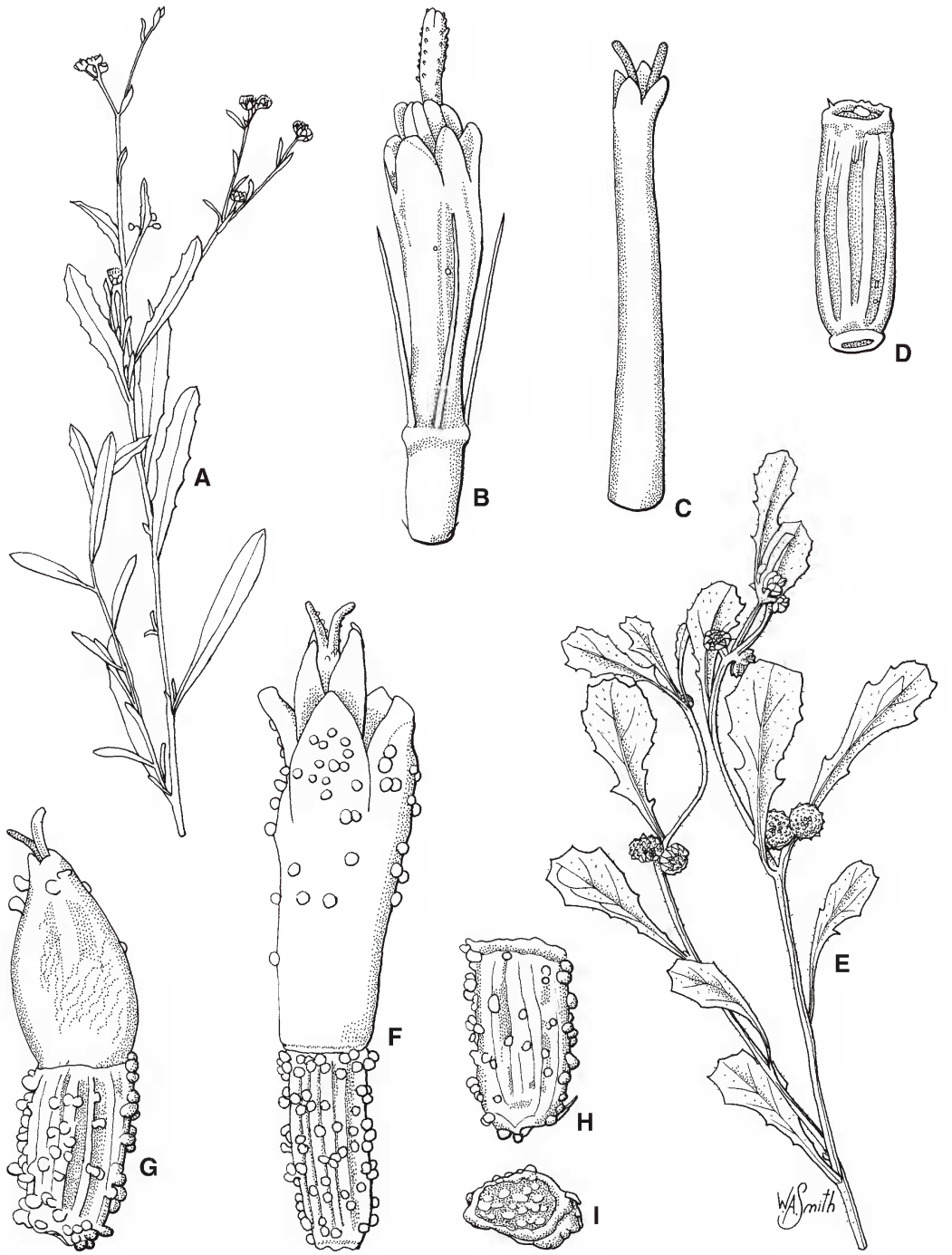

Fig. 1. A–D. ***Sphaeromorphaea major***. A. Flowering branchlet ×0.5. B. disc floret and infertile achene with pappus bristles ×16. C. marginal floret ×32. D. achene ×32. E–I, ***S. australis***. E. flowering branchlet ×1. F. disc floret ×32. G. marginal floret ×32. H. achene, lateral view ×32. I. achene, plan view ×32. A–D from *Bean 30830 & Halford* (BRI); E from *Bean 9548* (BRI); F–I from *Kemp 3362H & Kutt* (BRI). Del. W.Smith.

camp, 40 km NW of Gladstone, near Curtis Island, Dec 2004, *Batianoff 0412502 & Halford* (BRI); Targinnie district, 18.5 km NW of Gladstone, Nov 2011, *Fell DGF QEQ79/1* (BRI). MITCHELL DISTRICT: Bowen Downs, in 1873, *Birch s.n.* (MEL); Second Spring, Edgbaston Reserve, NE of Aramac, Apr 2012, *Bean 31643* (A, BRI, DNA, G, HO, MEL, NSW, to be distributed); Measuring Spring, Edgbaston Reserve, NE of Aramac, Apr 2012, *Bean 31646* (BRI, CANB); Edgbaston, Mar 1998, *Fensham 3464* (BRI). SOUTH KENNEDY DISTRICT: Little Moses Spring, Doongmabulla Station, 165 km NW of Clermont, May 2012, *Danielsen 1555* (BRI).

***Distribution and habitat*:** *Sphaeromorphaea major* is endemic to Queensland. It is known from some coastal locations near Rockhampton, and three inland locations at Edgbaston Reserve, Bowen Downs and Doongmabulla station (**Map 1**). On the coast, it is confined to those salt marsh areas (inundated by spring tides and dominated by grassland of *Sporobolus virginicus* (L.) Kunth) that apparently receive freshwater seepage from adjacent eucalypt or melaleuca forest. At the inland locations, it grows on the margins of artesian springs in open salt-encrusted areas dominated by *Cyperus laevigatus* L., but not where there is surface water.

***Phenology*:** Flowers and fruits have been recorded from September to April.

***Notes*:** Banks and Solander were the first to collect this species, from 'Bay of Inlets' (near Stanage Bay) in 1770, and Solander gave it the manuscript name *Cotula glabrata*. Robert Brown then collected it in 1802; the label on his specimen at BM [Bennett 2131] states that the plant was seen "in paludosis salsis Port 1, Keppel Bay, Shoalwater Bay [&] Broad Sound". 'Port 1' and 'Keppel Bay' are near the southern and northern ends of Curtis Island respectively (Vallance *et al.* 2001), places where there are no modern collections. The area covered by Brown's excursions at 'Broad Sound' (between the present-day towns of Ogmore and Carmila) is also without modern collections. For this species, there was a time lag of 243 years between the first herbarium collection and formal description. This lag figure is surely the highest on record for an Australian plant taxon, and it may well be a record not easily broken. Fontaine *et al.* (2012) found that, for species described in 2007, the average time lag (or 'shelf life') was around 21 years for all species, and around 32 years for plant species.

Sphaeromorphaea major differs from the sympatric *S. australis* by the achenes 1–1.3 mm long (0.65–0.9 mm long in *S. australis*); marginal florets 1.7–2.2 mm long (0.5–0.9 mm long in *S. australis*); leaves without resin globules (always present in *S. australis*, though sometimes hard to see); no resin globules on achenes or corolla (always present in *S. australis*).

The Edgbaston populations have a coronal pappus with a strongly fimbriate margin, while the coastal populations have an entire corona margin. The Doongmabulla specimen is intermediate with regard to this character, with a weakly fimbriate coronal pappus. There seem to be no other consistent morphological differences between the coastal and inland populations.

Sphaeromorphaea major can be distinguished by its narrow leaves and often very long peduncles. It is the only species in which the leaves lack eglandular multicellular hairs and resin globules. Furthermore, its disc florets are functionally male and the achenes produced are infertile, while in the other species the "disc achenes" are usually fully fertile.

***Conservation status*:** *Sphaeromorphaea major* is known from about 400 plants at Edgbaston Reserve near Aramac, on the margins of three springs. The population size at Doongmabulla station is unknown. Its continued existence at Bowen Downs is unknown. The author has observed several hundred plants at Shoalwater Bay Training Area, and Brown's recordings of it suggest that there is a strong possibility of extending the known distribution. However, in view of the very specialised habitat, the total area covered is unlikely to exceed 40 square km. Applying the Red List criteria (IUCN 2001), a status of 'Near Threatened' is recommended.

***Etymology*:** The specific epithet refers to the disc florets, which are larger in this species than in any other species of *Sphaeromorphaea*.

2. Sphaeromorphaea australis (Less.) Kitam., *Acta Phytotax. Geobot.* 5(4): 276 (1936), 6(2): 80 (1937); *Epaltes australis* Less., *Linnaea* 5: 148 (1830), *Syn. Gen. Compos.* 206 (1832); *Erigerodes australe* (Less.) O.Kuntze, *Revis. Gen. Pl.* 1: 335 (1891). **Type:** not cited (B, †). **Neotype (here designated):** Australia: New South Wales. Myall Creek road, Bungawalbin National Park, *c.* 22 km SSE of Casino, 30 December 2011, *A.R. Bean 31450* (neo: BRI [1 sheet + spirit]; iso: CANB, E, K, MEL, NSW, RSA, US, W, to be distributed).

Sphaeromorphaea petiolaris DC., *Prodr.* 6: 140 (1838). **Type:** [Australia: New South Wales.] Port Jackson, undated [in 1819], *C. Gaudichaud* (syn: G-DC, image!; P, image!); Port Jackson, undated [in 1823], *F.W. Sieber 697* (syn: G-DC, image!).

***Illustrations*:** Logan River Branch SGAP (2005: 130); Stephens & Sharp (2009: 44), both as *Epaltes australis*.

Prostrate to ascending perennial herb, to 30 cm high. Stems with sparse multicellular hairs when young, glabrescent. Leaves spathulate, obovate or oblanceolate, 26–70 × 7–21 mm, 2.6–5.3 times longer than broad, discolorous, resin globules present on both surfaces; young leaves with sparse multicellular hairs, often absent at maturity; margins dentate to denticulate, with 4–8 pairs of teeth up to 5 mm long, the longer lobes frequently on the attenuate basal part of the lamina; apex obtuse or acute. Capitula solitary or in pairs, leaf opposed, hemispherical to oblate, 2–3 mm long, 4–5.5 mm wide; peduncles 1–6 mm long. Involucral bracts incurved; median bracts ovate, 1.5–1.9 × 0.8–1.2 mm, glabrous or with a few resin globules on outer surface, apex acute. Marginal florets 150–300, in several rows, female; corolla lageniform, 0.5–0.9 mm long, pink to purple, resin globules few to numerous, apex very narrow. Disc florets 13–34, bisexual or functionally male; corolla narrowly campanulate, 1–1.3 mm long, 0.25–0.3 mm wide near base, 0.4–0.45 mm wide near apex, pink to maroon, resin globules present throughout; lobes 4, triangular, each *c.* 0.2 mm long; style undivided. Achenes formed from all florets, but those from disc florets sometimes infertile, white to pale yellow. Marginal achenes fertile, cylindrical, 0.65–0.9 mm long, 0.2–0.25 mm wide, brown, ribs 8–12, white, twin hairs absent or 1–4 at base; resin globules few to numerous, shining. Pappus corona transverse, obscure, translucent, 0.02–0.05 mm wide, with numerous radial striations, margin entire to erose; pappus bristles absent. **Fig. 1E-I.**

***Additional selected specimens examined*: Taiwan.** Tamsuy [Tan-shui], 1864, *Oldham s.n.* (GH); Houlung, Miaoli County, Aug 1968, *Kao 7364* (TAI). **New Caledonia.** Koutio-Kouéta, Dumbéa, Sep 1971, *McKee 24355* (NOU). **Australia: Western Australia.** 1 km N of Serpentine, Feb 1985, *Keighery 7182* (PERTH); Lambkin Reserve, Serpentine, Apr 1996, *Keighery 14346* (PERTH). **Queensland.** Cook District: Rocky Isles, Great Barrier Reef, *c.* 18 km S of Cooktown, Jun 1969, *Done s.n.* (BRI [AQ7513]). North Kennedy District: Alva Beach, Jun 1949, *Smith 4400* (BRI). South kennedy district: Western edge of Lake Buchanan, Yarrowmere Station, Mar 1998, *Kemp 3362H & Kutt* (BRI). Mitchell District: Myross, east of Aramac, May 2000, *Fensham 3885* (BRI). Leichhardt District: Baralaba – Woorabinda Road, 1.8 km W of Dawson Range, Mar 2005, *Bean 23551* (BRI); Humboldt, 45 km NE of Rolleston, Jan 1996, *Bean 9548* (BRI). Port Curtis District: Livingstone Shire Vegetation Survey, site 227 behind Lammermoon Beach, Sep 1977, *Batianoff 806 & McDonald* (BRI, CANB). Burnett District: Allies Creek SF, Compartment 146, W of Middle Creek Road, Apr 2004, *Halford Q8271 & Jessup* (BRI). Wide Bay District: Old Hollett Road, *c.* 5 km SW of Noosaville, Dec 2003, *Bean 21577* (BRI). Maranoa District: Around barracks, Carellen, *c.* 90 km WNW of Bollon, Mar 2008, *Bean 27456* (BRI). Darling Downs District: Girraween NP, 22 km S of Stanthorpe, Apr 2001, *Batianoff 210534 & Collyer* (BRI). Moreton District: Hay's Landing, Wivenhoe Dam, N of Fernvale, Jan 2001, *Bean 17303* (BRI). **New South Wales.** Tenterfield, May 1921, *Cheel s.n.* (NSW); Pilliga, Nov 1932, *Rupp 15* (NSW); Trial Bay to Laggers Point, NE of Kempsey, Jan 1953, *Constable s.n.* (NSW, US); *c.* 4 km by road W then N of Crowdy Head on road to Diamond Head, Mar 1981, *Haegi 2026* (AD, MEL, NSW); 3 miles [5 km] along Currambean Creek Road, 5 miles [8 km] S of Nowra, Mar 1951, *Ford s.n.* (NSW); Huskisson, Jervis Bay, Apr 1916, *Rodway 4509* (NSW).

***Distribution and habitat*:** *Sphaeromorphaea australis* occurs naturally in Australia and in New Caledonia. In Australia it extends from Ulladulla, New South Wales to Townsville, Queensland (with an outlier further north near Cooktown), and up to 600 km inland e.g. Lake Buchanan, Bollon, Pilliga (**Map 2**). It is naturalised in Taiwan (first collection in 1864) and near Perth, Western Australia (first collection in 1985) (**Map 3**). In New South

Wales and southern Queensland, it occupies a range of habitats in forest dominated by *Eucalyptus* spp., *Acacia harpophylla* F.Muell ex Benth. or *Melaleuca* spp., and sometimes in marine couch grassland adjacent to mangrove trees. Towards the northern end of its native range, the species appears to be increasingly confined to saline habitats, such as coastal salt marsh, artesian springs or the edges of saline inland lakes. Soil ranges from white sands to dark heavy clays.

***Phenology*:** Flowers and fruits can be found in any month of the year.

***Typification*:** Lessing (1830) catalogued all Asteraceae specimens held at the Berlin Botanical Museum (B), wherein he provided a three word description of *Epaltes australis* as a footnote, without mention of the specimen(s) upon which the name is based. Soon after, in his *Synopsis Generum Compositarum*, he (Lessing 1832) expanded the description of *E. australis* slightly, again without referring to the specimen(s) used. He did not explicitly give the country of origin, but did state that the genus is found in "Asiae vel Novae-Hollandiae vel Americae aequinoctialis". The other three species treated (*E. divaricata, E. mexicana, E. hirsuta*) were known to him from India, Mexico and India respectively, so it follows that *E. australis* is the Australian species.

While it is unclear from reading A.P. de Candolle's treatment of *E. australis* (de Candolle 1836) whether he viewed the specimen that Lessing used to describe it, in hindsight it is obvious that he did not. Candolle cited a specimen for *E. australis*, collected by Cunningham from the Lachlan River in New South Wales and thanks to a paper by O.W. Sonder (1853), we know this is not the correct application of the name *Epaltes australis*. Sonder examined both Lessing's specimen at B and the Cunningham specimen cited by de Candolle, and he indicated unambiguously (Sonder 1853: 482) that *E. australis sensu* de Candolle was not that of Lessing, and that *Ethulia cunninghamii* Hook. is synonymous with *E. australis sensu* de Candolle. He further stated (p. 485) that the cited specimens of *Sphaeromorphaea petiolaris* DC. belong to the same taxon as Lessing's (type) specimen of *Epaltes australis*. However, Sonder did not impart any information about the collector or provenance of Lessing's type specimen.

Nearly all material at B was destroyed during World War II (Hiepko 1987), including the type of *E. australis*, and the absence of information about the collector, date of collection or provenance of the type (except 'Novae-Hollandiae') means that there is no starting point to search for potential duplicate specimens. As no known type material exists for *E. australis*, a neotype is here chosen from material collected in "Novae-Hollandiae", i.e. Australia, and from the taxon that occurs around Sydney, the most likely collection site of the original specimen.

***Notes*:** *Sphaeromorphaea australis* is distinguished from other species in the genus by its dark green leaves, the frequent presence of conspicuous lobes on the basal attenuate part of the lamina; the lageniform marginal florets; the narrow and inconspicuous coronal pappus; the lack of pappus bristles; and the absence (usually) of hairs at the base of the achene. Leaves are often glabrous at maturity, but specimens from the more westerly areas have leaves that often retain some hairs at maturity.

In Queensland, its distribution overlaps extensively with *Sphaeromorphaea subintegra*, but both species maintain their identities without any sign of intergradation or hybridization. *S. subintegra* may be differentiated by its pale green leaves with persistent (though often sparse) hairs and denticulate margins (teeth < 0.5 mm long), the conical marginal florets, and the relatively broad and conspicuous coronal pappus.

***Conservation status*:** A common and widespread species.

3. Sphaeromorphaea harrisii (F.Muell.) A.R.Bean **comb. nov.;** *Epaltes harrisii* F.Muell., *Fragm.* 11: 101 (1880); *Erigerodes harrisii* (F.Muell.) O.Kuntze, *Revis. Gen. Pl.* 1: 335 (1891). **Type:** Australia: Queensland. Cook District: Possession Island, in 1880, *C.C. Harris s.n.* (lecto [here designated]: K

000373331; isolecto: MEL 2159948, NSW 582206).

***Illustrations*:** Britten (1901: t. 158), as *Epaltes australis*; Dunlop (2000: 185), as *Sphaeromorphaea australis*.

Erect annual or perennial herb to 35 cm high. Stems with dense multicellular hairs when young, hairs persistent. Leaves spathulate to oblanceolate, 22–61 × 7–21 mm, 2.5–3.8 times longer than broad, discolorous or concolorous, resin globules present on both surfaces; young leaves with dense multicellular hairs, fully expanded leaves sparsely to densely hairy; margins dentate to lyrate, rarely denticulate, with 6–10 pairs of teeth up to 5 mm long; apex acute. Capitula solitary or in pairs, hemispherical to cupular, 3–3.5 mm long, 4.5–6 mm wide; peduncles 1–3 mm long. Involucral bracts incurved; median bracts ovate, 2–2.5 × 0.7–1.1 mm, glabrous, apex acute. Marginal florets 200–300, in several rows, female; corolla lageniform, 0.9–1.3 mm long, maroon to purple, resin globules few or none, apex very narrow. Disc florets 15–31, bisexual; corolla cylindrical, 1.25–1.4 mm long, *c.* 0.3 mm wide near base, *c.* 0.35 mm wide near apex, pink to maroon, resin globules scattered throughout; lobes 4, triangular, 0.2–0.25 mm long; style undivided; pappus bristles sometimes present. Achenes formed from all florets, but those from the disc florets sometimes infertile, white to pale yellow, not ribbed. Marginal achenes fertile, cylindrical, 0.7–1.1 mm long, 0.2–0.3 mm wide, brown, ribs 6–10, white, twin hairs 5–20 at base; resin globules numerous. Pappus corona transverse, pale and translucent, 0.05–0.08 mm wide, margin entire to erose; pappus bristles absent or present, slender, without barbellae, 0–6 per floret, 0.1–1 mm long. **Fig. 2A-E.**

***Additional selected specimens examined*: Papua New Guinea.** Western Province: Arufi, Wassi Kussa River, Jul 1968, *Henty & Katik NGF38641* (A, BRI, CANB, K, L); Bula Plains, Morehead subdistrict, Nov 1972, *Henty & Foreman NGF49355* (A, BRI, CANB, K, L, LAE); Garmari on the Bula Plains, *c.* 30 km S of Bensbach Lodge, Apr 1997, *Mitchell 4696* (BISH, BRI, LAE); Balamuk, Bensbach River, *c.* 9 km S of Bensbach Wildlife Lodge, May 1992, *Waterhouse BMW2503 & Obedi* (BRI). **Australia: Northern Territory.** Nhulunbuy Lagoon, Oct 1993, *Egan 2804* (DNA). **Queensland.** Cook District: Saibai Island, Sep 1994, *Wannan 130* (BRI); [North] Possession Island [Iem Islet], Sep 1792, *Smith & Wiles s.n.* (BM); Possession Island, in 1880, *Harris s.n.* (MEL2162771); Thursday Island, June 1897, *Bailey s.n.* (BRI [AQ247412]); 1 km S of Seisia, 250 m from beach, Nov 1999, *Wannan 1412* (BRI, CANB, NSW); New Holland, in 1770, *Banks & Solander s.n.* (BRI [AQ450752]; MEL); Bolt Head, Temple Bay, Jul 1991, *Forster PIF8985* (BRI, DNA, MEL); Coen River [Pennefather River], Gulf of Carpentaria, Nov 1802, *Brown s.n.* (CANB); 8.5 km NW of Weipa Mission, Dec 1974, *Specht W243 & Salt* (BRI); Evans Landing rubbish dump, Weipa, Aug 1996, *Waterhouse BMW3918* (BRI); 11 km N of the Chester River Crossing, W of the Embley Range, Silver Plains Station, Jun 1992, *Forster PIF10539 et al.* (BRI); 18.6 km from Running Creek on the track to Old Port Stewart, Jun 1993, *Clarkson 10103 & Neldner* (BRI, DNA, L, MEL); Lakefield NP, 29.4 km by road from Hann River Crossing, Aug 2011, *McDonald KRM11779* (BRI); East of mouth of Muck River, Cape Melville NP, Jul 1998, *Bean 13666* (BRI); Lakefield NP, 22.8 km by road N of Ranger base, Aug 2011, *McDonald KRM11776* (BRI); Lizard Island, Nov 1997, *Muir s.n.* (BRI [AQ667812]); Lizard Island, Dec 1974, *Specht LI420 & Specht* (BRI). North Kennedy District: Edmund Kennedy NP, near Cardwell, Jan 1992, *Bean 3912* (BRI, DNA, MEL).

***Distribution and habitat*:** In Australia *Sphaeromorphaea harrisii* occurs along the east coast of Queensland from Cardwell to Cape York and on several of the Torres Strait islands as well as in the north-eastern Northern Territory. It is also found in southern Papua New Guinea (**Map 4**). It grows on a wide range of soil types, from sand to black clay, on floodplains and riverbanks where *Melaleuca* spp. or *Lophostemon suaveolens* (Sol. ex Gaertn.) Peter G.Wilson & J.T.Waterh. are dominant. It also occurs at the base of sand dunes, and in *Sporobolus virginicus* grassland adjacent to mangrove communities.

***Phenology*:** Flowers and fruits can be found in any month of the year.

***Typification*:** The original material of *Epaltes harrisii* (now distributed in K, MEL and NSW) comprises numerous very young plants that bear only one or two capitula. Most capitula are immature; only the material at K has florets at anthesis, hence the K sheet has been selected as the lectotype.

There is a second gathering of *S. harrisii* at MEL (MEL2162771) with the same label details as the type. This sheet comprises three mature plants bearing many flowers and mature achenes. Judging by the description

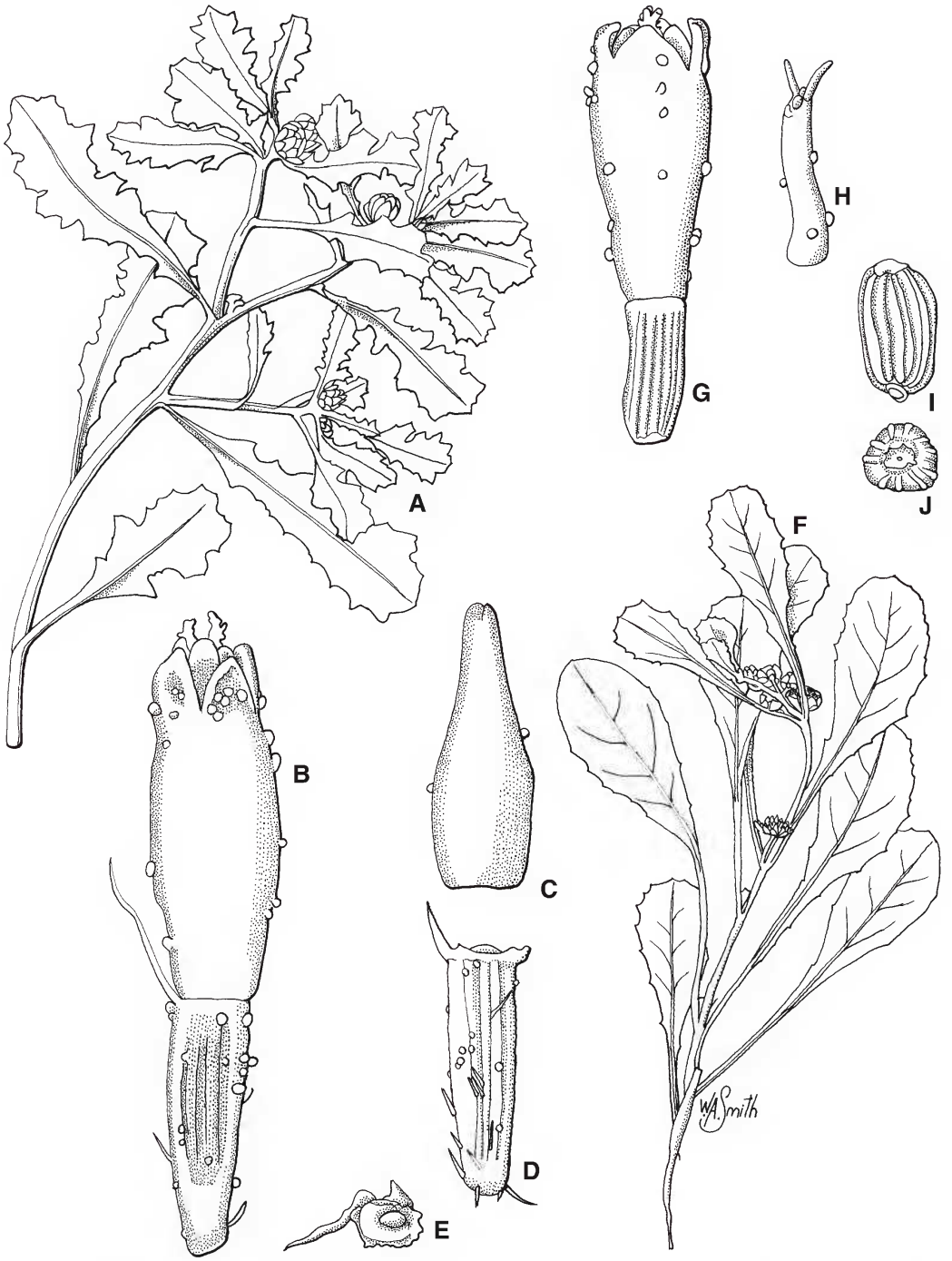

Fig. 2. **A–E**, ***Sphaeromorphaea harrisii***. A. Flowering branchlet ×1. B. disc floret and achene with pappus bristle ×32. C. marginal floret ×32. D. achene, lateral view ×32. E. achene, plan view ×32. **F–J, *S. ephemera***. F. flowering branchlet ×1. G. disc floret and achene ×32. H. marginal floret ×32. I. achene, lateral view ×32. I. achene, plan view ×32. A, from *Forster PIF10539 et al.* (BRI); B–E from *McDonald KRM11779* (BRI); F–J from *Forster PIF22217 & Booth* (BRI). Del. W.Smith.

in the protologue, Mueller did not use this collection when naming the species and hence it cannot be considered a type.

***Notes*:** *Sphaeromorphaea harrisii* is distinctive in the erect stems, the lageniform marginal florets with few or no resin globules; capitula not as broad as in other species; the very short peduncles (often *c.* 1 mm long); the frequent presence of pappus bristles; and the achenes with few (6–10) ribs. It is perhaps closest to *S. australis*, but differs from that species by the more upright habit, persistently hairy leaves, the longer corolla of the marginal florets, the broader coronal pappus and the frequent presence of pappus bristles.

Pappus bristles are present on most *S. harrisii* collections, but completely lacking in others (including the type). There is no geographical basis to this variation. For example, *Specht LI420 & Specht*, from Lizard Island, is without pappus bristles; while *Muir s.n.*, also from Lizard Island, has numerous pappus bristles.

***Conservation status*:** A common and widespread species.

***Etymology*:** This species was named for Charles Christopher Harris (1844–1887), an amateur naturalist. He was borne in Maine, U.S.A., and immigrated to Australia in the 1860s. He arrived at Cooktown in 1873 or 1874, and resided there until his death. He was accidently killed while on board the sailing vessel 'Spey' on 30th April 1887, when the boom struck him on the head (M.Scully pers. comm.; National Library of Australia (2009–onwards)).

4. Sphaeromorphaea ephemera A.R.Bean **sp. nov.** affinis *S. australi* sed habitu annuo, flosculis foemineis conicis et acheniis brevioribus globulis resinae carentibus differens. **Typus:** Australia: Queensland. Gregory North District: Bladensburg National Park, S of Winton, Opalton Road, 19 March 1998, *P.I. Forster PIF22217 & R. Booth* (holo: BRI).

Prostrate to ascending annual herb, to 15 cm high. Stems with sparse multicellular hairs when young, glabrescent. Leaves spathulate to oblanceolate, 14–53 × 5–17 mm, 2.8–4.8 times longer than broad, discolorous, resin globules present on both surfaces; young leaves with sparse multicellular hairs, usually absent at maturity; margins dentate to denticulate, with 3–12 pairs of teeth mostly < 0.5 mm long, but with some up to 2 mm long; apex obtuse. Capitula solitary or in pairs, leaf opposed, hemispherical, 1.5–2 mm long, 4–5 mm wide; peduncles 1–7 mm long. Involucral bracts incurved; median bracts ovate, 1.4–2.3 × 0.5–0.9 mm, glabrous or with a few resin globules on outer surface, apex acute. Marginal florets 100–200, in several rows, female; corolla conical, 0.6–0.7 mm long, pink to purple, broadest at base, few to several resin globules present, apex narrow. Disc florets 13–24, bisexual; corolla cylindrical to narrowly campanulate, 1–1.1 mm long, 0.25–0.3 mm wide near base, 0.25–0.35 mm wide near apex, pink to maroon, resin globules present throughout; lobes 4, each *c.* 0.2 mm long; style undivided. Achenes formed from all florets, cylindrical, tapered at both ends, 0.45–0.7 mm long, 0.15–0.2 mm wide, brown, ribs 10–14, white, twin hairs absent; resin globules absent, or rarely 1 or 2. Pappus corona transverse, obscure, translucent, 0.01–0.04 mm wide, with numerous radial striations, margin entire; pappus bristles absent. **Fig. 2F–J.**

***Additional specimens examined*: Queensland.** South Kennedy District: Cudmore, Apr 1997, *Fensham 3130* (BRI). Mitchell District: Lake Inveresk, 70 km NNE of Muttaburra, Mar 2004, *Cumming 22432 & Thompson* (BRI). Warrego District: Mariala NP, 52.5 km east by road from Adavale, Aug 2009, *Forster PIF35727 & Thomas* (BRI); Road reserve, south of Biloola HS, 2 km off Adavale Road, west of Charleville, May 2010, *Wang JW0180* (BRI); 60 km NW [actually WSW] of Charleville, off the Diamantina Developmental Road, Jun 1976, *Purdie 373D* (BRI).

***Distribution and habitat*:** Endemic to western Queensland, between Adavale and Winton (**Map 1**). Most occurrences are along drainage lines under shrubland of *Acacia aneura* F.Muell. ex Benth., often with emergent *Eucalyptus populnea* F.Muell., and in red clayey soils. One site is on the margins of a salt lake, with fine sandy soil.

***Phenology*:** Flowers and fruits have been recorded from March to August.

***Affinities*:** *Sphaeromorphaea ephemera* is apparently related to *S. australis*, but differs by the conical marginal florets, the annual habit, and the shorter achenes that lack resin globules. *S. ephemera* differs from *S. littoralis* by the glabrescent leaves, the shorter achenes that lack resin globules, the absence of twin hairs on the achenes, and the narrower pappus corona.

***Conservation status*:** Data deficient. While the species is known from just a few specimens, it is potentially common.

***Etymology*:** From the Greek *ephemeros*, meaning 'short-lived'.

5. Sphaeromorphaea littoralis (Retz.) A.R.Bean **comb. nov.**; *Artemisia littoralis* Retz., *Observ. Bot.* 5, p. 28 (1789); *Epaltes littoralis* (Retz.) Less., *Linnaea* 6: 151 (1831). **Type:** seashores of eastern India, undated [1768–1785], *J.G. Koenig s.n.* (lecto, here designated: C 10007263, image!).

Epaltes hirsuta Less., *Syn. Gen. Compos.* 206 (1832). **Type:** 'In India orientali lecta in herbario Thunbergiano', *J.P. Röttler s.n.*, *n.v.*

Cotula quinqueloba Blanco, *Fl. Filip. [F.M. Blanco]* 626 (1837), *nom. illeg. non* L.f. (1782).

Sphaeromorphaea russeliana DC., *Prodr.* 6: 140 (early Jan 1838); in Deless., *Icon. Sel.* 4, t. 49 (Feb 1838); *Sphaeromorphaea russeliana* DC. var. *russeliana*, *Prodr.* 6: 140 (early Jan 1838); in Deless., *Icon. Sel.* 4, t. 49 (Feb 1838); *Centipeda russeliana* (DC.) F.Muell. as '*russelliana*', *Fragm.* 8: 142 (1874). **Type:** India. The Circars, undated [1781–1790], *P. Russell s.n.* (syn: G-DC, image!; syn: K-W, image!).

Cotula russeliana Wall., *Numer. List [Wallich]* 3240 (1831), *nomen nudum*

***Illustrations*:** Gagnepain (1924: 557), as *Sphaeromorphaea russeliana*; Cunningham *et al.* (2011: 685), as *Epaltes australis*.

Prostrate to sprawling perennial herb, to 25 cm high. Stems with dense multicellular hairs when young, hairs persisting at maturity. Leaves spathulate to oblanceolate or obovate, 9–60 × 4–15 mm, 2.3–4.8 times longer than broad, concolorous, resin globules present on both surfaces; young leaves densely hairy, hairs sparse to dense at maturity; margins dentate to denticulate, with 4–14 pairs of teeth usually less than 1 mm long, but occasionally up to 2 mm long; apex acute. Capitula solitary or in pairs, hemispherical, 2.5–3.5 mm long, 3.5–7 mm wide; peduncles 2–14 mm long. Involucral bracts incurved, glabrous; median bracts ovate, 1.6–2.3 × 0.8–1.2 mm, glabrous or with few to many resin globules on outer surface, apex acute. Marginal florets *c.* 200, in several rows, female; corolla conical, 0.7–1.2 mm long, pink to purple, resin globules numerous, apex very narrow. Disc florets 16–40, bisexual; corolla cylindrical, 1.1–1.4 mm long, 0.25–0.4 mm wide, pink, resin globules present throughout; lobes 4, triangular, each 0.2–0.3 mm long; style undivided, arms parallel. Achenes formed from all florets, 0.7–1.3 mm long, 0.25–0.35 mm wide, brown, ribs 8–14; twin hairs 10–40, mainly at base but with some scattered above; resin globules numerous, shining. Pappus corona transverse, circular or somewhat pentagonal, 0.05–0.09 mm wide, with numerous radial striations, margin entire, erose or rarely toothed; pappus bristles usually absent, rarely present. **Fig. 3.**

***Additional selected specimens examined*: India.** Hazaribagh, Apr 1884, *Clarke 34806* (K); Eastern India, *s.dat.*, *Koenig s.n.* (LD); Visakhapatnam, Waltan Beach near university, Sep 1969, *Rao 7101* (CAL). **China Southeast.** Chung Chi college, Hong Kong, Apr 1972, *Hu 11888* (A, K, US); Nanning, Guangxi province, Nov 1935, *Liang 67192* (PE); Yongning, Guangzi province, Jul 1958, *Zhong A62026* (PE). **Hainan:** Yaichow, Hainan Island, Sep 1933, *Liang 62870* (GH, US); Danzhou county, Hainan, May 1928, *Tsang 16813* (PE, US). **Thailand.** Nawng Kai, Chaiyaburi, Feb 1924, *Kerr 8543* (BM); Klong Hoy Kong, Songkla province, May 1986, *Maxwell 86-305* (A); Kao Sabab, Chantaburi, Feb 1935, *Seidenfaden 2735* (C). **Vietnam.** Near beach, Tourane, May–Jul 1927, *Clemens & Clemens 3079* (BM, K, US); Phu Yen province, Jan 1936, *Petelot 6285* (GH, US); Nha Trang, *s.dat.*, *Poilane 6046* (K, US). **Malaysia.** Near Kampong Padangnegeri, Kuala Trengganu, Jul 1953, *Sinclair 39806 & Salleh* (BM); Tumpat, Kota Bahru, Feb 1917, *Ridley 535* (K). **Philippines.** Manila, Jan 1915, *Merrill Species Blancoanae No 773* (AMES, BM, CAL, GH, NSW, US); Caloocan, province of Rizal, Luzon, Nov 1903, *Merrill 3655* (US). **Marianas.** southern end of Cabras Island, Guam, Mar 1966, *Evans 1673* (US); Waste ground just inland from Asan Point, Guam, Jun 1983, *Raulerson 4561* (US). **Australia: Western Australia**. Piccaninny Creek Gorge, 15 km SE of Bungle Bungle Outcamp, Bungle Bungle Range, Apr 1985, *Blackwell BB297* (PERTH); King Edward River, old CRA

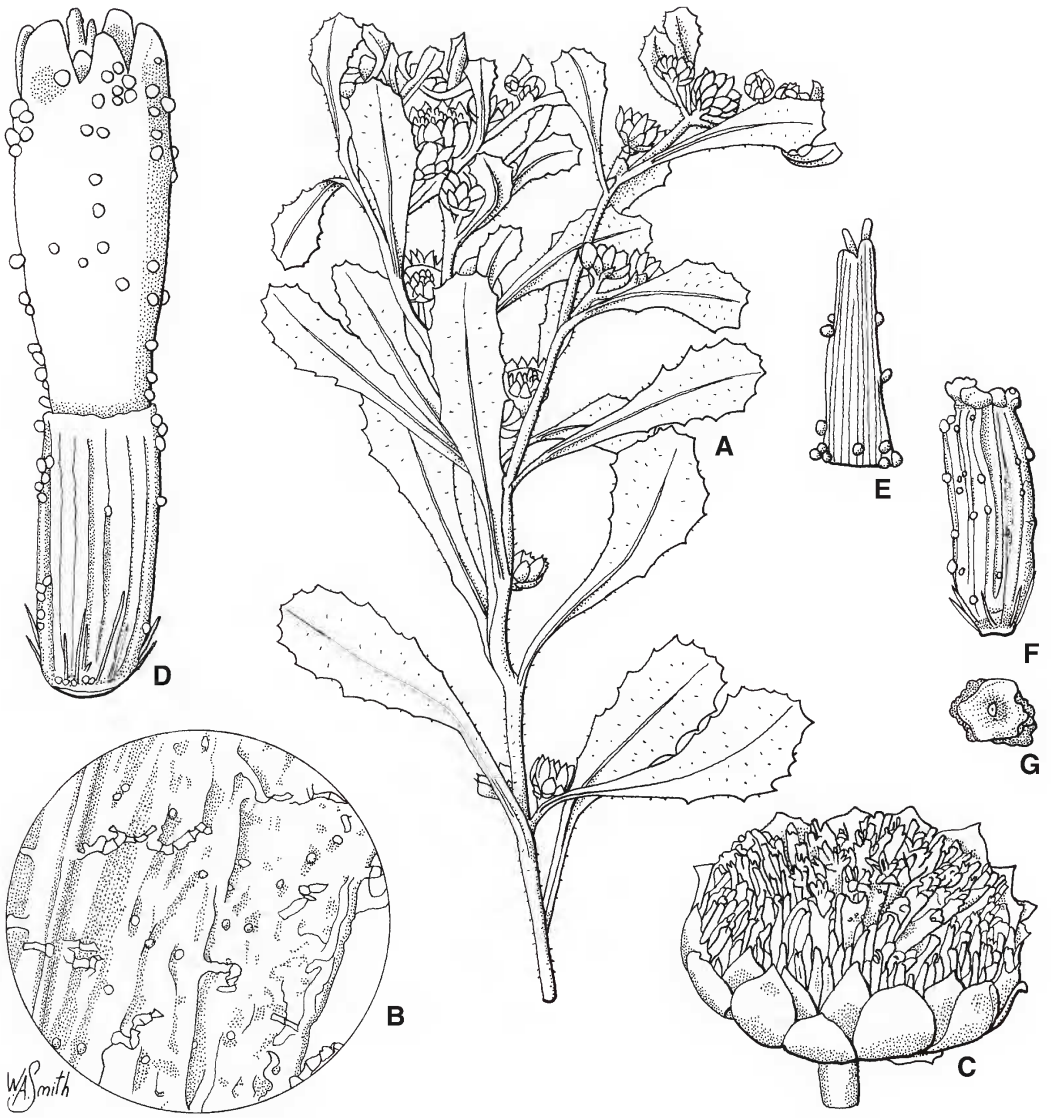

Fig. 3. ***Sphaeromorphaea littoralis***. A. Flowering branchlet ×1.5. B. leaf surface with resin globules and eglandular multicellular hairs ×24. C. flowering capitulum ×8. D. disc floret and achene ×32. E. marginal floret ×32. F. achene, lateral view ×32. G. achene, plan view ×32. A–B from *Bean 23777* (BRI); C from *Brass 8806* (BRI); D–G from *Badman 1473* (AD). Del. W.Smith.

campsite, 1 km S of track to old Mitchell River Station, Jun 1988, *Edinger 541* (DNA, PERTH); Drysdale River above Mogurnda Creek, Drysdale River NP, Aug 1975, *George 13570* (CANB, PERTH). **Northern Territory.** 1.5 km NE of Fish River Gorge in China Wall, Barkly Tableland, Jun 1974, *Kanis 1823* (CANB, DNA, L, US); SE corner of entry to Lake Surprise, Mar 1973, *Maconochie 1672* (DNA, MO, NSW); Mary Ann Dam, *c.* 5km NE of Tennant Creek, May 2005, *Bean 23777* (BRI); *c.* 12 miles [*c.*19 km] NE Finniss River HS, Oct 1971, *Must 842* (CANB, DNA, NSW); Near mouth of Foelsche River, Jul 1948, *Perry 1829* (AD, BRI, CANB, MEL, NSW, US). **South Australia**. Carruranna Waterhole, Cooper Creek, 32 km WNW of Etadunna HS, Feb 1984, *Badman 1473* (AD, BRI, CANB, MEL, NSW); *c.* 1 km N of Big Bend S of Swan Reach, May 1973, *Donner 4113* (AD, BRI); Sunnyside opposite Mypolonga on riverbank, Dec 1961, *Symon 1926* (AD,

BRI). **Queensland.** Cook District: Cumberland, Gilbert River, May 1937, *Brass 8806* (BRI). Burke District: eastern shore of Lake Moondarra, 16 km NNE of Mt Isa, Oct 1997, *Fraser 245* (A, CANB). Mitchell District: Yalleroi, Mar 1946, *Clemens s.n.* (BRI [AQ247452]; GH). Gregory North District: SE edge of Lake Machattie, *c.* 70 km SE of Bedourie, May 2007, *Bean 26406* (BRI). Warrego District: Currawinya NP, Lake Numalla, Mar 1996, *Forster PIF18688* (BRI). **New South Wales.** Cobar, Sep 1910, *Abrahams 387* (NSW); 4 miles [6 km] S of Gwabegar, between Baradine and Pilliga, Nov 1967, *McGillivray 2746* (NSW); Cobham Lake, *c.* 32 km SSE of Milparinka, Mar 1972, *Milthorpe 711* (NSW). **Victoria.** Dimboola, Feb 1901, *D'Alton s.n.* (NSW); Post No 7 on Hattah Nature Drive, Hattah NP, Jan 1989, *D'Aubert 483* (MEL, NSW); On SW side of Lake Lockie, 465 m NNE (at 188 degrees) from the E end of Lockie Track, Mar 2007, *Stajsic 4364* (MEL, NSW).

***Distribution and habitat*:** *Sphaeromorphaea littoralis* is widely distributed in southern Asia, with native occurrences in India, Thailand, Vietnam, Malaya, Philippines and southeastern China. It is naturalised on the island of Guam (**Map 6**). In Australia, it is indigenous in the Kimberley region of Western Australia, South Australia, Northern Territory, western Queensland, western New South Wales and north-western Victoria (**Map 5**). The species inhabits sunny places on the margins of creeks and dams, saline coastal flats and swamps, and in Australia extends into areas receiving very low annual rainfall. Soils are variable.

***Phenology*:** Flowers and fruits may be found at any time of the year.

***Typification*:** I am aware of just two specimens of *Artemisia littoralis* that were collected by J.G. Koenig – one at C and one at LD. The LD specimen is notable for the presence of 1 or 2 pappus bristles, up to 0.6 mm long, on many of its achenes. The specimen at C lacks these bristles, and it is therefore deduced that these two specimens were from separate gatherings. The C specimen is superior in quality, and pappus bristles are not mentioned in the protologue; hence it is chosen as the lectotype.

Type material of *Epaltes hirsuta* was sought from all herbaria that are listed as having collections of C.P. Thunberg or J.P. Röttler (HUH 2012), but without success. However, I consider it a synonym of *S. littoralis*; the words "capitulis solitariis vel geminis" given in the protologue strongly suggests that *E. hirsuta* is a *Sphaeromorphaea*, and the "tota hirsuta" accords with the hairy Indian form of *S. littoralis*.

***Notes*:** *Sphaeromorphaea littoralis* differs from *S. australis* by the grey-green hairy leaves (green glabrous leaves in *S. australis*); the conical-shaped marginal florets that have numerous resin globules (lageniform florets with few resin globules for *S. australis*); the prominent corona on the achenes; and the numerous hairs at the base of the achene.

Sphaeromorphaea littoralis differs from *S. subintegra* by the longer teeth on the leaf margins, presence of teeth on the basal half of the leaves, fully expanded leaves moderately to densely hairy, mostly longer peduncles (to 14 mm, versus 1.5–3.5 for *S. subintegra*), and the presence of numerous antrorse hairs at the base of the achene.

Australian specimens of *S. littoralis* tend to have larger leaves than is usual for Asian specimens. Indian and northern/central Australian specimens are generally densely hairy, while specimens from south-east Asia (e.g. Thailand, China) and around the Murray River in southern Australia are generally only sparsely hairy. According to Cunningham *et al.* (2011), it is completely ignored by domestic livestock.

The collector of the type of *S. russeliana* was Patrick Russell, usually spelt with two "l's" (Hawgood 1994). However, early references (Wallich 1831; Wight 1831; De Candolle 1838) cited his surname as 'Russel', while Lowndes (1834) cited his surname as 'Russel' or 'Russell'. The spelling of the epithet 'russeliana' by de Candolle (1838) was clearly intentional and that spelling must be maintained (Art. 60).

Wallich (1831) included a Russell manuscript name (*Artemisia chrysanthemum*) as a synonym of his *Cotula russeliana* [Cat. 3240]. The latter, also a *nomen nudum*, was later validated as *Sphaeromorphaea russelliana* DC. The epithet *chrysanthemum* means 'golden-yellow flowers', and so some later accounts (Hooker 1882; Li 1978; Naithani 1995) and some specimen labels have stated

that *Sphaeromorphaea* has yellow flowers. All taxa and populations of *Sphaeromorphaea* known to the present author have pink, purple, maroon or (rarely) white florets, and the occurrence of yellow flowered populations is considered highly unlikely. It is probable that Russell's manuscript name referred to another species *e.g. Grangea maderaspatana* (L.) Poir., and Wallich merely misapplied it.

Sphaeromorphaea littoralis is naturalised at Guam, being first recorded in 1966 (Fosberg & Sachet 1980), adjacent to the Naval Base.

***Conservation status*:** A common and widespread species.

6. Sphaeromorphaea subintegra A.R.Bean **sp. nov.** affinis *S. australi* sed in foliis dentibus aequabiliter parvis, pappo coronali comparate lato et conspicuo, pilis persistentibus in foliis maturis et corolla foeminea conica (in *S. australi* lageniformi) differens. **Typus:** Australia: Queensland. South Kennedy District: Lambert Beach, Slade Point, Mackay, 16 July 1992, *G.N. Batianoff 9207103 & H.A. Dillewaard* (holo: BRI; iso: MEL).

Prostrate to ascending perennial herb, to 25 cm high. Stems with sparse to dense multicellular hairs when young, hairs ± persistent. Leaves spathulate to obovate, 14–50 × 4–19 mm, 2.4–3.7 times longer than broad, discolorous, resin globules present on both surfaces; young leaves with moderately dense multicellular hairs, some hairs persisting at maturity; margins denticulate, with 3–12 pairs of small teeth < 0.5 mm long; apex obtuse. Capitula solitary or in pairs, leaf-opposed, hemispherical, 2–3 mm long, 5–6 mm wide; peduncles 1.5–3.5 mm long. Involucral bracts incurved; median bracts 1.5–2.5 × 0.8–0.9 mm, glabrous or with a few resin globules on outer surface, apex acute. Marginal florets 150–300, in several rows, female; corolla conical, 0.6–0.9(–1) mm long, mauve to purple, broadest at base, with few to numerous resin globules; apex narrow. Disc florets 22–44, bisexual; corolla cylindrical to narrowly campanulate, 0.9–1.3 mm long, 0.25–0.35 mm wide near base, 0.25–0.4 mm wide near apex, pink to maroon, resin globules numerous; lobes 4, triangular, each 0.15–0.25 mm long; style undivided. Achenes formed from all florets, cylindrical, 0.7–0.9 mm long, 0.25–0.3 mm wide, brown, ribs 10–14, twin hairs absent or 1–4 at base; resin globules numerous, shining. Pappus corona transverse, obvious, white to grey, 0.05–0.08 mm wide, margin entire to erose; pappus bristles absent or very rarely present. **Fig. 4A-E.**

***Additional selected specimens examined*: Papua New Guinea.** Milne Bay Province: Narian, Misima Island, Aug 1956, *Brass 27606* (A); Joe's Landing, Sudest Island, Aug 1956, *Brass 27780* (A, US). Western Province: Daru, near airstrip, Jun 1973, *Henty NGF49517* (A, BRI); Daru Island, Sep 1963, *Womersley NGF17786* (BRI). **New Caledonia.** Presqu'île de Ouano, Sep 1971, *Raynal 16504* (NOU). **Australia: Queensland.** Cook District: Booby Island, Great Barrier Reef, *c.* 34 km from Thursday Island, Jul 1969, *Heatwole s.n.* (BRI [AQ8142]); East of the Mossman to Daintree Road north of Wonga Beach, Sep 2002, *Jago 6297* (BRI); Mareeba, Jan 1918, *White s.n.* (BRI [AQ247418]). North Kennedy District: E of Mount Garnet, Feb 2008, *Wannan 4999* (BRI, NSW); Little Ramsay Bay, Hinchinbrook Island, Apr 2012, *Mathieson MTM1327* (BRI, NSW); Snake Creek, *c.* 95 km NW of Charters Towers on Gregory Developmental Road, Apr 1991, *Batianoff SC9104010* (BRI). South Kennedy District: Brampton Island near airstrip, Sep 1986, *Batianoff 5123* (AD, BRI); Black Wattle Creek Crossing, on Gregory Development Road, May 1991, *McFadyen 453* (BRI); Collinsville Coal Pty Ltd mine lease area, near Collinsville and Scottville, Apr 1984, *Thompson 587* (BRI). Leichhardt District: 8.8 km from Mt Dillingen peak and *c.* 87 km NNE of Clermont, Feb 1999, *Bailey LB65* (BRI); 45.8 km from Taroom, on road to Bauhinia Downs, May 2010, *Bean 29617* (BRI). Port Curtis District: 200m down road to St Lawrence from Bruce Highway, Jul 1998, *Thompson 1317* (BRI); Facing Island, Oct 2004, *c.* 0.7 km NW of Catcombe, *Halford Q8670* (BRI). Burnett District: About 3.3 km SE of Culcraigie along Culcraigie – Eidsvold Road, Apr 1997, *Pollock ABP391* (BRI); Toondahra HS yards, Jun 1989, *Forster PIF5076* (BRI, US). Wide Bay District: Near Maroondan, E of Gin Gin, Nov 1996, *Bean 11229* (BRI).

***Distribution and habitat*:** *Sphaeromorphaea subintegra* is recorded from southern lowland parts of Papua New Guinea, New Caledonia, and in Australia is widespread in eastern Queensland from the Torres Strait islands to Mundubbera (**Map 7**). It grows on wet or moist microhabitats in open forest and woodland dominated by *Eucalyptus* or *Melaleuca*, often on alluvium, but also on hillsides and plateaux. Soils vary from sand to reddish basaltic clay, and including soils derived from serpentinite. It has not been recorded from salt marsh communities.

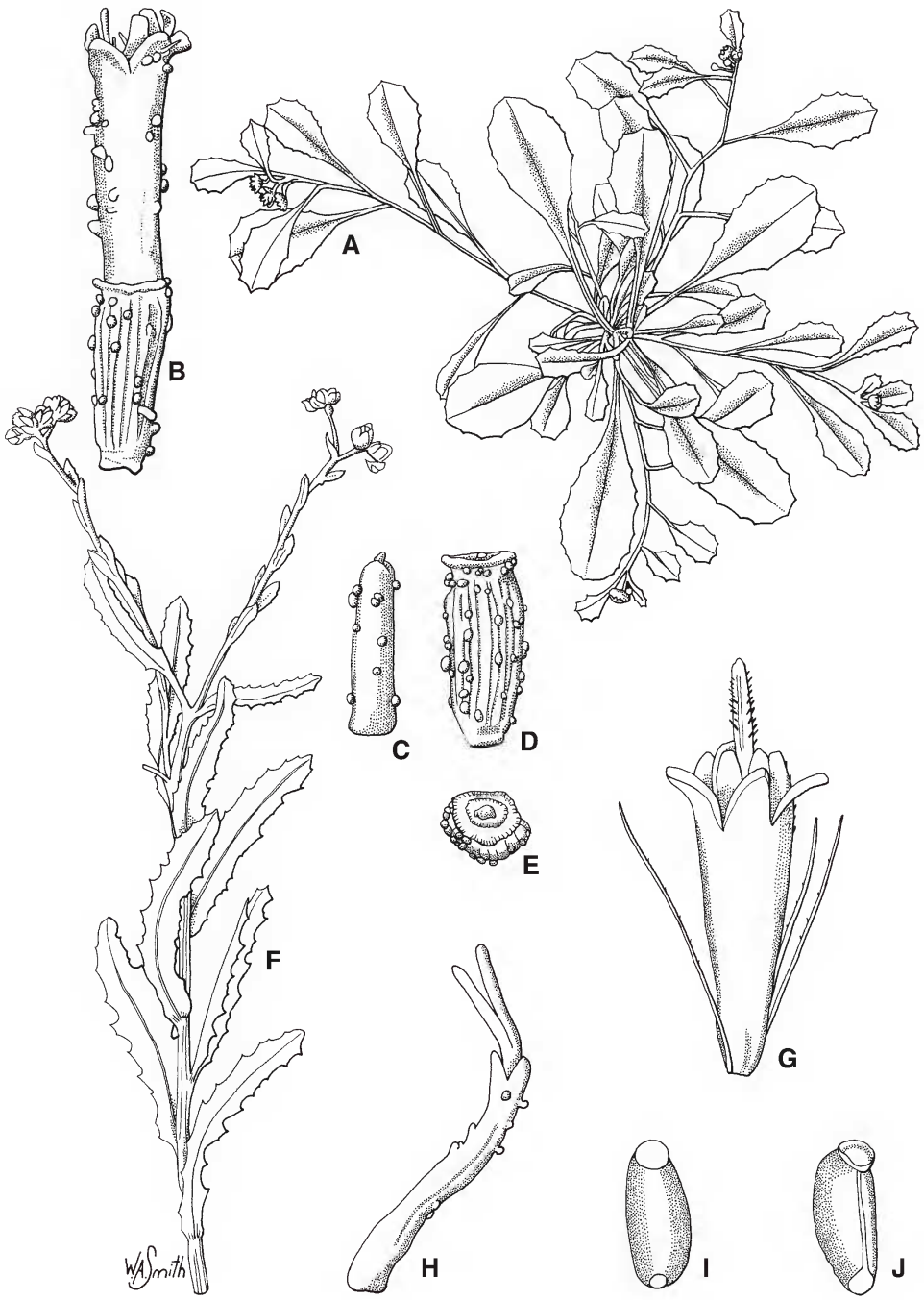

Fig. 4. **A–E**, ***Sphaeromorphaea subintegra***. A. Flowering plant ×0.6. B. disc floret and achene ×32. C. marginal floret ×32. D. achene, lateral view ×32. E. achene, plan view ×32. **F–J, *Ethuliopsis cunninghamii***. F. flowering branchlet ×1. G. disc floret ×16. H. marginal floret ×32. I. achene, abaxial view ×32. J. achene, adaxial view ×32. A, from *Bean 29617* (BRI); B–E from *McFadyen 453* (BRI); F, from *Cowan 81* (BRI); G, from *Mitchell 824* (BRI); H–J from *Emerson s.n.* (BRI [AQ501325]). Del. W.Smith.

***Phenology*:** Flowers and fruits can be found in any month of the year.

***Notes*:** *Sphaeromorphaea subintegra* differs from *S. australis* by the consistently small teeth on the leaves (no more than 0.5 mm long), the relatively broad and conspicuous coronal pappus, persistent hairs on mature leaves, and the marginal corolla conical in shape. Field observations and herbarium specimen labels suggest that where the distributions of this species and *S. australis* overlap, *S. subintegra* inhabits the more mesic sites (where fresh water is more readily available), whereas *S. australis* inhabits salt-affected sites, including salt marsh or headlands near the ocean, or sites that may dry out more quickly. No intergradation between these two species has been observed in the field or in the herbarium, even though they sometimes occur less than a kilometre from each other.

S. subintegra differs from *S. littoralis* by the lobing of the leaves (more conspicuously lobed in *S. littoralis*) and the very few twin hairs on the achene, if any (numerous twin hairs in *S. littoralis*).

The oldest herbarium specimen of *S. subintegra* that I have seen is one collected by Ernst Betche at Cooktown in 1881.

***Conservation status*:** A common and widespread species.

Ethuliopsis F.Muell., *Fragm.* 2: 154 (1861); *Epaltes* sect. *Ethuliopsis* (F.Muell.) F.Muell., *Fragm.* 10: 100 (1877). **Type:** *E. dioica* F.Muell. (= *E. cunninghamii*).

Gynaphanes Steetz in Peters, *Naturw. Reise Mossambique [Peters]* 6(2): 457 (1864). **Type:** *Gynaphanes australis* (= *Ethuliopsis cunninghamii*).

Perennial herbs. Latex absent. Stems terete, not winged. Leaves alternate, sessile, toothed, spreading, not decurrent. Capitula pedunculate, in terminal panicles; on some plants disciform and heterogamous; on other plants homogamous, with disc florets only. Involucral bracts variable in length, cartilaginous, in 3–6 rows. Receptacle glabrous, without paleae. Marginal florets fertile, female, without rays; corolla lobes 3, tiny; style base not bulbous, branches divergent. Disc florets bisexual, functionally male, ovary vestigial, not producing achenes. Anthers tailed, apically obtuse. Style base not bulbous, style undivided at apex; sweeping hairs obtuse, extending well down the shaft. Achenes lunate, with a single longitudinal rib on adaxial side; carpopodium annular, white, prominent. Pappus on the marginal florets comprising a persistent erect cylindrical corona; on the disc florets comprising 3–6 barbellate bristles.

A monotypic genus, endemic to Australia.

Ethuliopsis cunninghamii (Hook.) F.Muell., *Key to the System of Victorian Plants* 1: 313 (1888); *Ethulia cunninghamii* Hook. in T.Mitch., *J. Exped. Trop. Australia* 62 (1848); *Ethuliopsis dioica* F.Muell, *Fragm.* 2: 155 (1861), *nom. illeg.*; *Gynaphanes australis* Steetz in Peters, *Naturw. Reise Mossambique [Peters]* 6(2): 458 (1864), *nom. illeg.*; *Epaltes cunninghamii* (Hook.) Benth., *Fl. Austral.* 3: 530 (1867); *Erigerodes cunninghamii* (Hook.) O.Kuntze, *Revis. Gen. Pl.* 1: 335 (1891). **Type citation:** "We saw ... Also an ETHULIA, which may, on further examination, constitute a new genus; it was found by Allan Cunningham on the Lachlan." **Type:** Australia: New South Wales. Swampy banks of the Lachlan River, 26 June 1817, *A. Cunningham 290/1817* (lecto [here designated]: K 000373334; isolecto: G-DC).

***Illustrations*:** Cunningham *et al.* (2011: 685), as *Epaltes cunninghamii*.

Erect herb, to 100 cm high. Stems glabrous. Leaves oblong to oblanceolate, 20–69 × 4.5–17 mm, 3.6–8.5 times longer than broad, bright green, concolorous, resin globules sometimes present on lower surface; glabrous or with sparse multicellular hairs; margins denticulate to dentate with 5–13 pairs of teeth each 0.3–3 mm long; apex obtuse or acute; base cuneate to obtuse. Capitula in small terminal panicles. Peduncles 0–4.5 mm long, glabrous or sparsely glandular-hairy. *Homogamous capitula*: Capitula cylindrical to campanulate at anthesis, 3.5–5 mm long, 2.5–5.5 mm wide. Involucral bracts flat,

glabrous, outer ones much shorter than inner; median involucral bracts 3.1–3.5 × 0.6–1.1 mm, apex obtuse, margin entire. Receptacle flat. Marginal florets absent; disc florets 20–35, bisexual; corolla narrowly campanulate, 2–3.1 mm long, 0.2–0.3 mm wide near base, 0.5–1 mm wide near apex, white, resin globules present throughout; lobes 5, 0.25–0.3 mm long; style undivided; ovary vestigial; pappus bristles 2–6, 1.9–2.6 mm long, barbellate, slightly flattened, often bent or twisted near apex. *Heterogamous capitula*: Capitula globose at anthesis, 2.5–3 mm long, 2.5–3 mm wide. Involucral bracts incurved, glabrous; outer ones much shorter than inner; median bracts 2–2.7 × 1–1.2 mm, apex obtuse, glabrous, margin entire or denticulate. Receptacle hemispherical. Marginal florets 100–200, in several rows, female; corolla filiform, 0.8–1.3 mm long, white, cylindrical, multicellular hairs absent, few to numerous resin globules present; lobes 3, tiny; styles slender, branched. Disc florets 2–16, bisexual; corolla narrowly campanulate, 1.2–1.5 mm long, 0.2–0.3 mm wide near base, *c.* 0.5 mm wide near apex, white, resin globules present throughout; lobes 5, 0.25–0.3 mm long; style undivided; ovary vestigial; pappus bristles 2–6, 0.8–1.1 mm long, barbellate, slightly flattened, often bent or twisted near apex. Achenes formed only from marginal florets, lunate, 0.6–0.7 mm long, *c.* 0.2 mm wide, with 1 conspicuous longitudinal rib, and several raised anastomosing veins sometimes visible; twin hairs absent; resin globules absent. Pappus corona obliquely placed, erect, cylindrical, white, 0.03–0.05 mm high, margin entire; pappus bristles absent. **Fig. 4F-J.**

***Additional selected specimens examined*: Australia: South Australia.** Katarapko Reserve, N of Loxton, Jul 1985, *Alcock 10249* (AD, MEL, NSW, NY); 7 km W of Mundondna HS, May 1984, *Badman 1022* (AD, CANB, MEL, NSW); Waukatanna waterhole, Cooper Creek, Apr 1985, *Badman 1646* (AD, BRI, MEL); 50 km SE of Coongie, Lake Eyre basin, Oct 1986, *Conrick 1939* (AD, BRI, NSW); Pandiburra Bore, Aug 1975, *Donner 5177* (AD, US); Neals River, 56 km S of Oodnadatta on track to William Creek, Nov 1989, *Nordenstam & Anderberg 972* (AD, MEL, NSW, PERTH); Engenina Creek, on the Coober Pedy – William Creek Road, Sep 1990, *Wilson 789 & Rowe* (AD, MEL, NSW). **Queensland.** Gregory North District: Cuttaburra Channels, Eyre Development Road, S of Bedourie, May 2007, *Bean 26385* (BRI, MEL); 116 km N of Birdsville, Sep 1989, *Cowan 81 & Bushell* (BRI). Warrego District: *c.* 15 km W of Quilpie, Nov 1975, *Henderson H2384* (BRI). Gregory South District: Thylungra, *c.* 75 miles [*c.* 121 km] NW of Quilpie, Oct 1955, *Everist 5768* (BRI); 1.3 km S of Plevna Downs HS gate, W of Eromanga, Aug 2010, *Bean 30103* (BRI); Lake Yamma Yamma, Sep 1991, *Mitchell 824* (BRI); Windorah, 'Tanbar', Cooper Creek, Nov 1990, *Emerson s.n.* (BRI [AQ 501325]). **New South Wales.** Yantara Lake, Oct 1887, *Baeuerlen s.n.* (NSW); 15.1 km SW of Goodooga, Dec 1998, *Bean 14508* (BRI, NSW); Near Barrier Range, Feb 1861, *Beckler s.n.* (MEL); Delalah Downs, Aug 1972, *Cunningham 476* (BRI, NSW); Willandra Creek, *c.* 28 miles [*c.* 43 km] SE of Ivanhoe, Nov 1973, *Salasoo 5427* (NSW). **Victoria.** Kings Billabong Wildlife Reserve, near Red Cliffs, Aug 1975, *Beauglehole 50256* (AD, MEL); Kings Billabong, Red Cliffs area, May 1969, *Henshall s.n.* (MEL); W of Neds Corner HS, Mullaroo Creek, 5.5 km due N of Lake Wallawalla, Lindsay Island, Dec 1981, *Browne 73* (MEL); Lake Lalbert, Dec 1853, *Mueller s.n.* (MEL).

***Distribution and habitat*:** *Ethuliopsis cunninghamii* is widely distributed in south-western Queensland, western New South Wales, eastern South Australia and north-western Victoria (**Map 8**), in areas that receive less than about 600 mm annual rainfall. It grows in heavy clay soil on alluvial flats, and around ephemeral swamps and lakes. Associated species include lignum (*Muehlenbeckia florulenta* Meisn.), gidgee (*Acacia cambagei* R.T.Baker), coolabah (*Eucalyptus coolabah* Blakely & Jacobs), and bluebush (*Chenopodium auricomum* Lindl.).

***Phenology*:** Flowers and fruits have been recorded from March to December, but flowering and fruiting is most likely synchronised to rainfall events rather than season.

***Notes*:** *Ethuliopsis* is distinct from both *Epaltes sens. str.* (*E. divaricata*) and from *Sphaeromorphaea*, and would appear to be more closely related to some members of the large genus *Pluchea*. The latter is a very complex and possibly paraphyletic assemblage (Anderberg *et al.* 2005), and none of the *Pluchea* species in Australia or south-east Asia have characters similar to those exhibited by *Ethuliopsis*.

Ethuliopsis cunninghamii is sub-dioecious. Some plants have homogamous capitula that bear only disc florets. These florets are bisexual, but do not produce

achenes and the ovary is vestigial, hence they are effectively male. The capitula on these plants are campanulate or cylindrical, the median involucral bracts are 3.1–3.5 mm long, and the corolla of the disc florets is 2–3.1 mm long. Other plants have heterogamous capitula that bear predominantly marginal florets, with a few disc florets in the centre. The capitula on those plants are globose, the median involucral bracts are 2–2.7 mm long, and the corolla of the disc florets is 1.2–1.5 mm long. Hence, specimens of the "male" and "female" plants can be readily distinguished by capitulum shape and size, or by floret size. The corolla of both marginal and disc florets is white, unlike *Sphaeromorphaea* spp. (except marginal florets of *S. major*) and *Epaltes divaricata* which are pink to purple.

There is one herbarium specimen reportedly collected from the Northern Territory. It is at MEL, and has a handwritten label written in ink stating "118. Epaltes cunninghamii B., 1885/6, Lieut. Dittrich, Lindsay's Exped." Someone else has later written, in pencil, "finke river". As this species has never otherwise been recorded from the Northern Territory, it seems likely that the locality is in error, and that the specimen was in fact collected in South Australia.

***Conservation status*:** A common and widespread species.

Key to the Australian genera of Subtribe *Plucheinae*

1 Capitula grouped into secondary heads or glomerules **2**
1. Capitula all separate **3**

2 Pappus absent . . . . . **Sphaeranthus**
2. Pappus present . . . . . **Pterocaulon**

3 Pappus of the marginal florets consisting of a small corona, sometimes with 1–5 bristles arising from it **4**
3. Pappus of all florets with 10 or more bristles, corona absent **5**

4 Achenes cylindrical, with 5–14 longitudinal ribs; capitula all heterogamous, hemispherical to oblate; corolla pink to purple, rarely white . . . . . **Sphaeromorphaea**
4. Achenes lunate, with 1 longitudinal rib; capitula heterogamous or homogamous, campanulate or globose; corolla white . . . . . **Ethuliopsis**

5 Pappus bristles fused into a tube at their base . . . . . **Coleocoma**
5. Pappus bristles all free **6**

6 Pappus bristles broad-based, persistent, ebarbellate . . . . . **Thespidium**
6. Pappus bristles slender throughout, somewhat caducous, barbellate **7**

7 Disc florets 3-merous; anthers not tailed . . . . . **Allopterigeron**
7. Disc florets 4-merous or 5-merous; anthers tailed **8**

8 Corolla of marginal florets irregularly lobed to distinctly ligulate; achenes densely sericeous . . . . . **Streptoglossa**
8. Corolla lobes of marginal florets equal; achenes glabrous or sparsely hairy . . . . . **Pluchea**

Excluded names in *Epaltes* and *Sphaeromorphaea*

Epaltes alata (Sond.) Steetz in Peters, *Naturw. Reise Mossambique [Peters]* 6(Bot., 2): 452 (1864) = **Litogyne gariepina** (DC.) Anderb.

Epaltes gariepina (DC.) Steetz in Peters, *Naturw. Reise Mossambique [Peters]* 6(Bot., 2): 451 (1864) = **Litogyne gariepina** (DC.) Anderb.

Epaltes pleiochaeta F.Muell., *Fragm.* 10: 100 (1877) = **Pluchea baccharoides** (F.Muell.) Benth.

Epaltes tatei F.Muell., *Trans. & Proc. Roy. Soc. South Australia* 6: 31 (1883) = **Haegiela tatei** (F.Muell.) P.S.Short & Paul G.Wilson.

Sphaeromorphaea centipeda DC., *Prodr.* 6: 140 (1838). An illegitimate name based on *Artemisia minima* L. (= **Centipeda minima**).

Centipeda sect. *Sphaeromorphaea* C.B.Clarke, *Compos. Ind.* 151 (1876) is typified by *Centipeda orbicularis nom. illeg.* (= **Centipeda minima**). This sectional name is therefore a synonym of *Centipeda.*

Sphaeromorphaea russeliana var. *glabrata* DC., *Prodr.* 6: 140 (1838). **Type:** NW India, J.F. Royle *s.n.* (syn: K 000373336, image!) = **Centipeda minima** subsp. **minima**. A Royle specimen at G-DC [G00318749] identified as var. *glabrata* is evidently from a different gathering. It bears the number 260, and the locality Cachemire [?], rather than the 'prov. bor.-occid.' as stated in the protologue. This latter specimen is not considered a type. It represents *Sphaeromorphaea littoralis.*

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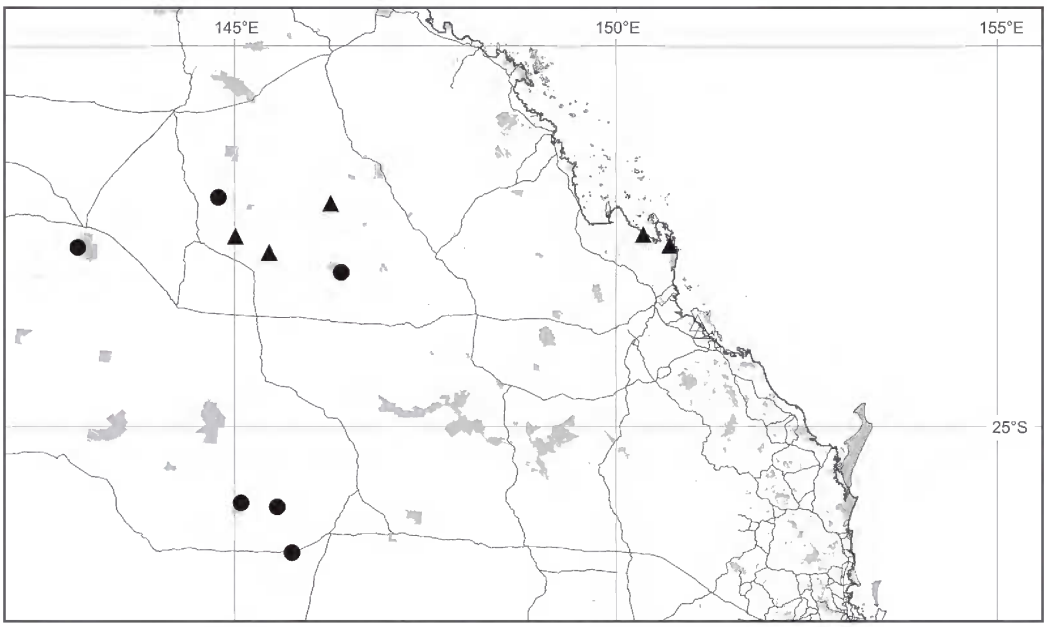
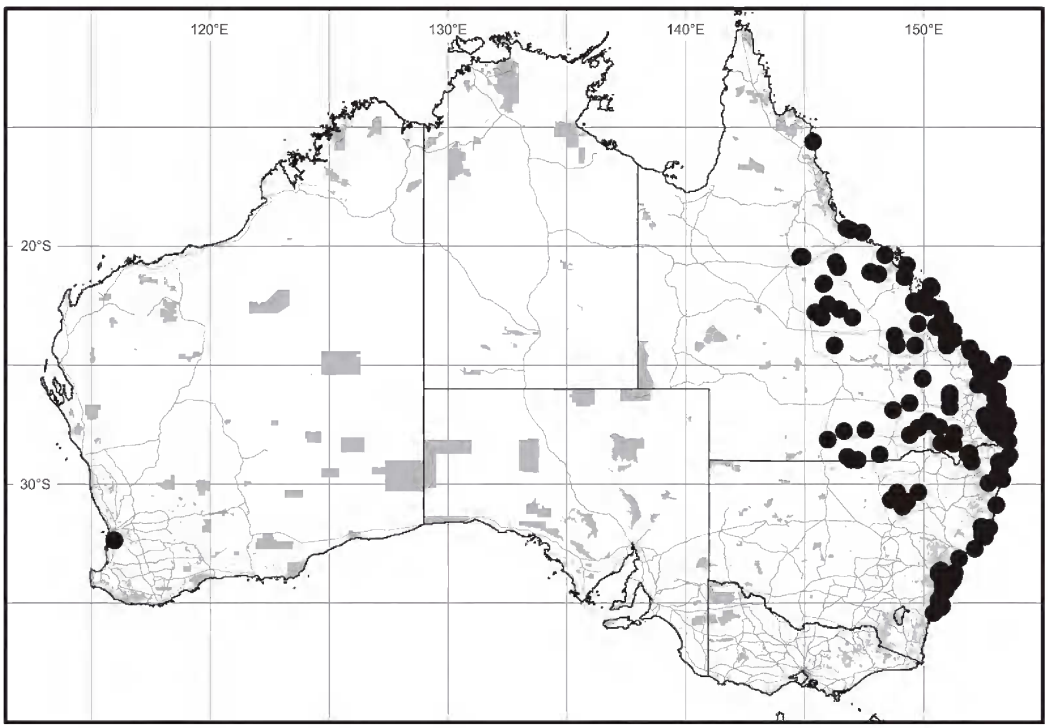
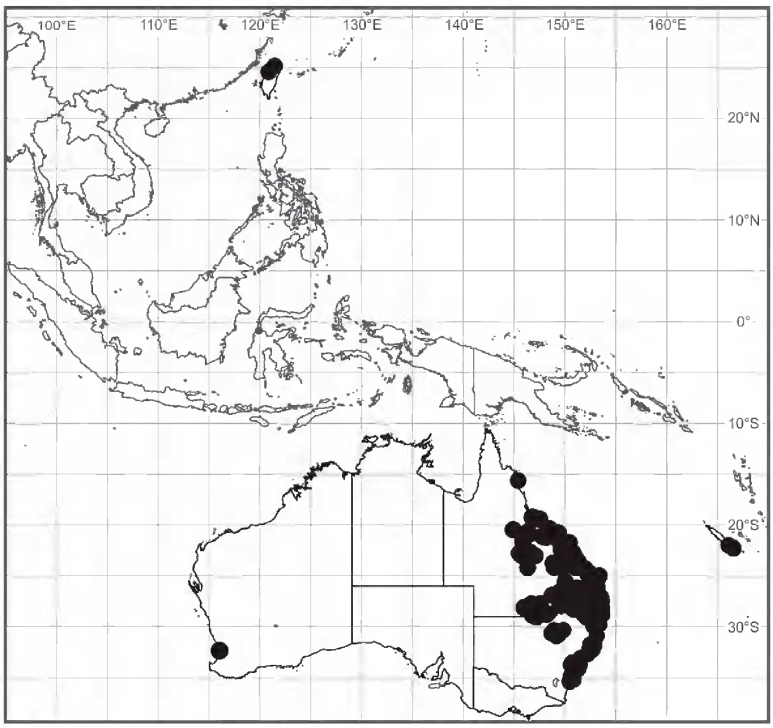


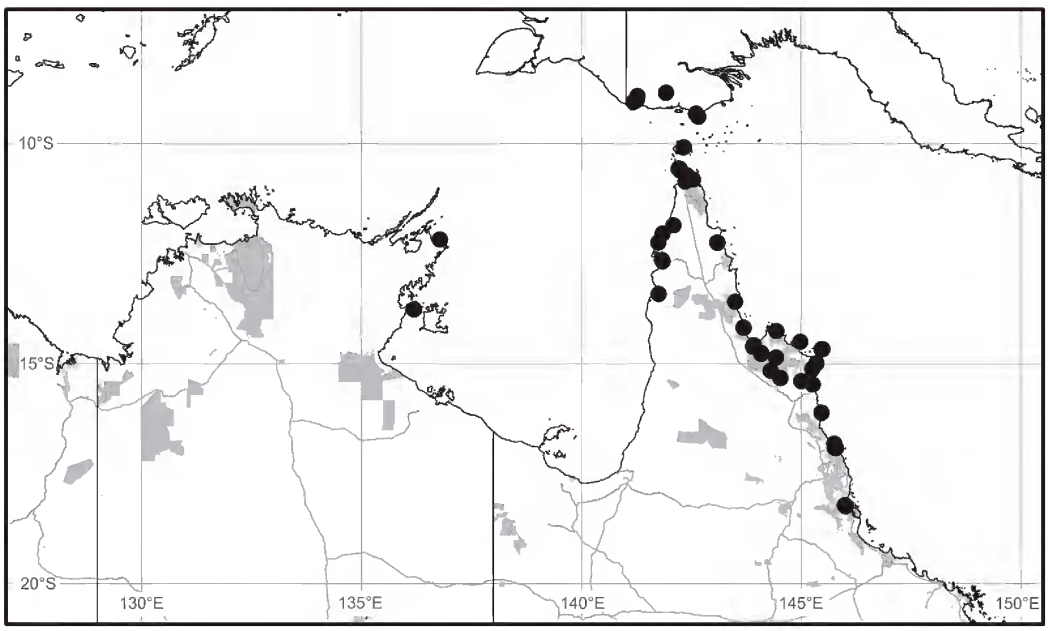
Map 1. Distribution of *Sphaeromorphaea ephemera* (circle) and *S. major* (triangle).



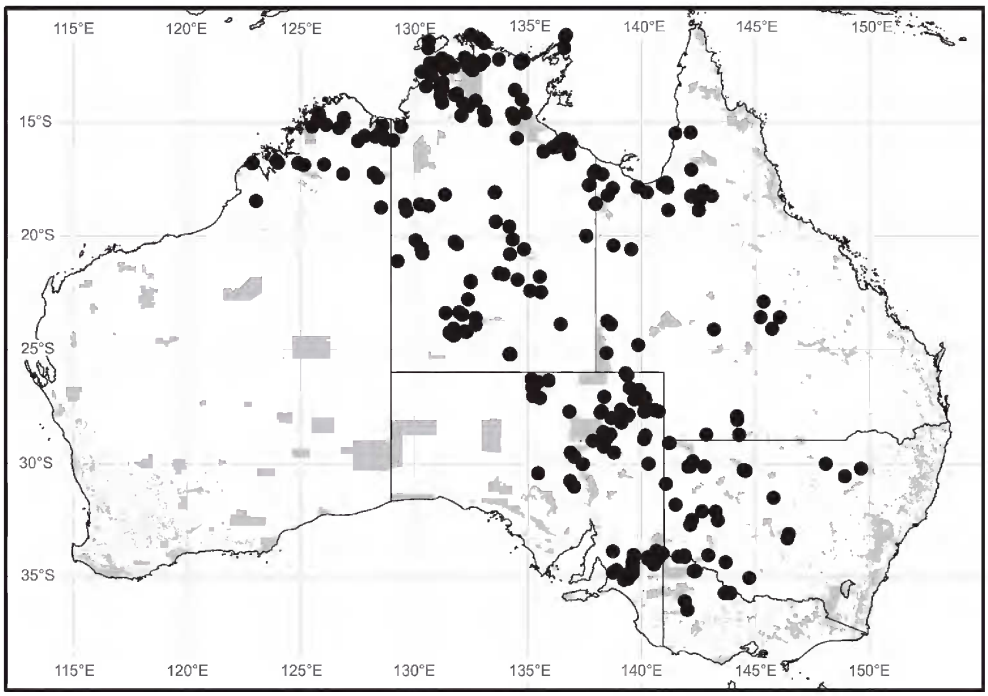
Map 2. Australian distribution (native and naturalised) of *Sphaeromorphaea australis*.



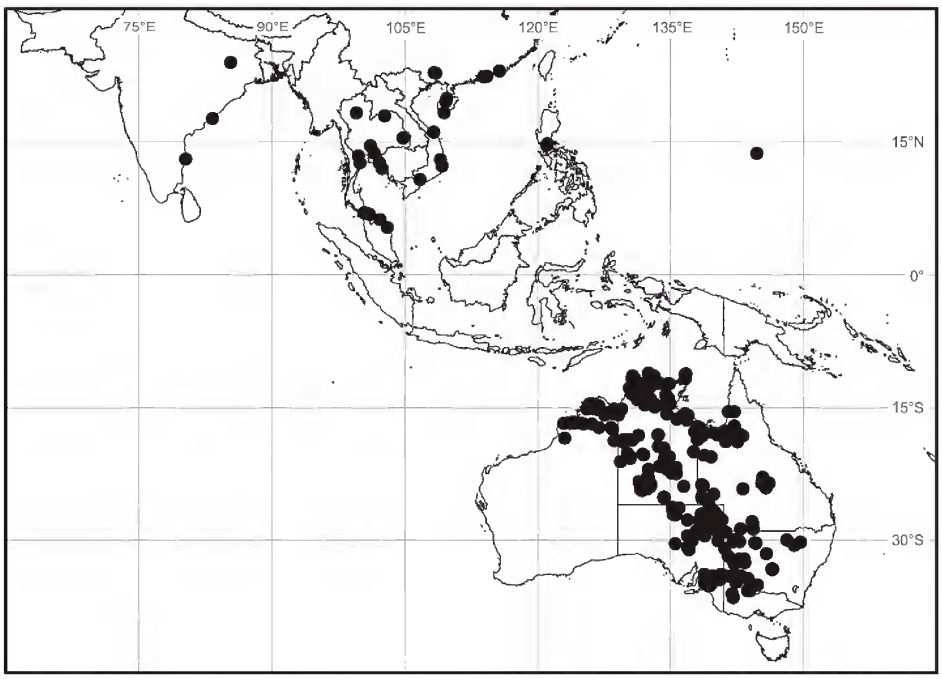
Map 3. World distribution (native and naturalised) of *Sphaeromorphaea australis*.



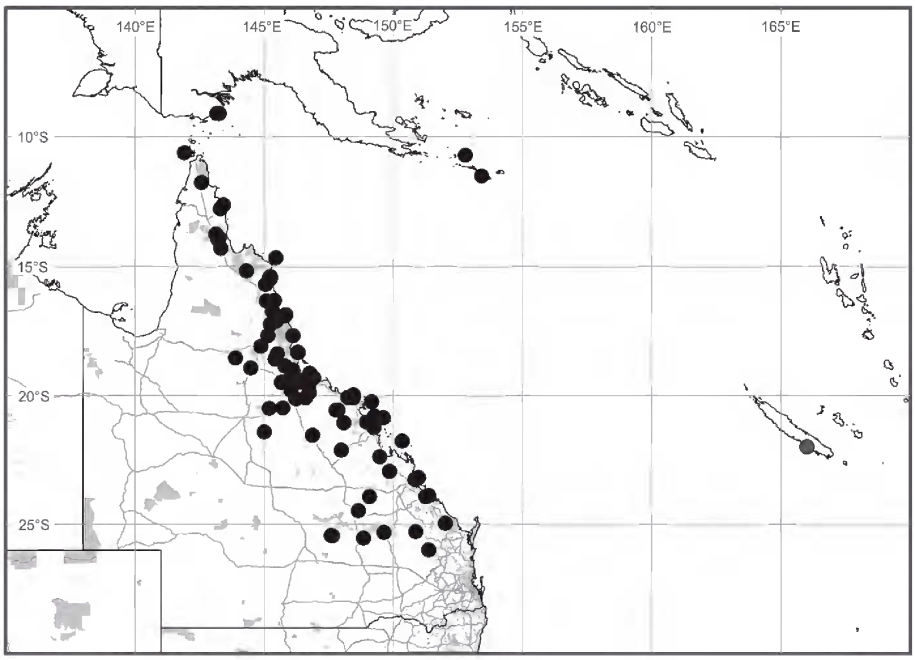
Map 4. World distribution of *Sphaeromorphaea harrisii*.



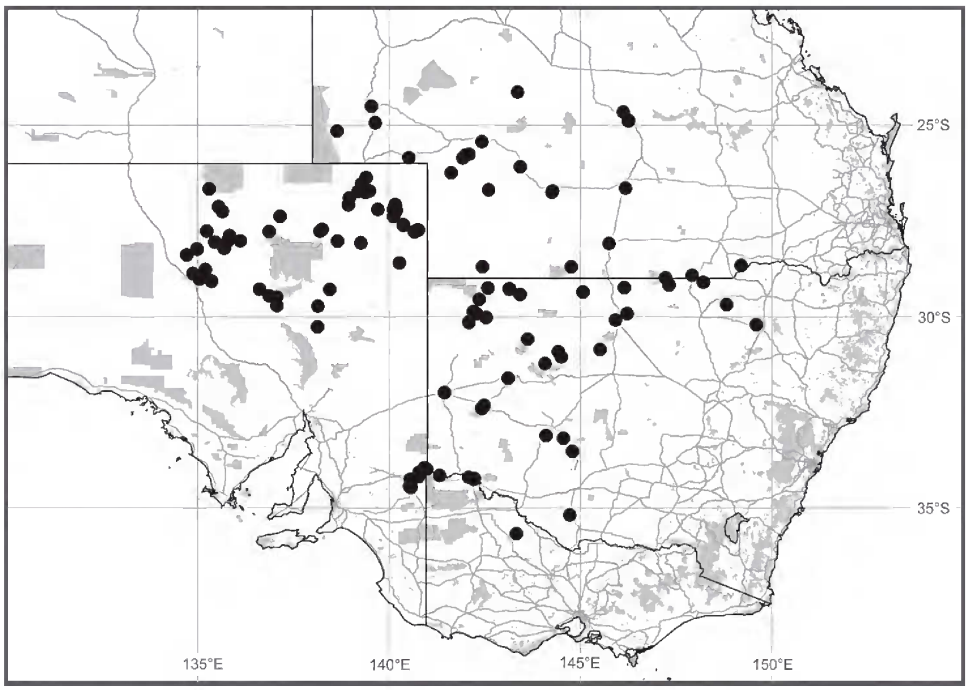
Map 5. Australian distribution of *Sphaeromorphaea littoralis*.



Map 6. World distribution (native and naturalised) of *Sphaeromorphaea littoralis*.



Map 7. World distribution of *Sphaeromorphaea subintegra.*



Map 8. Distribution of *Ethuliopsis cunninghamii.*